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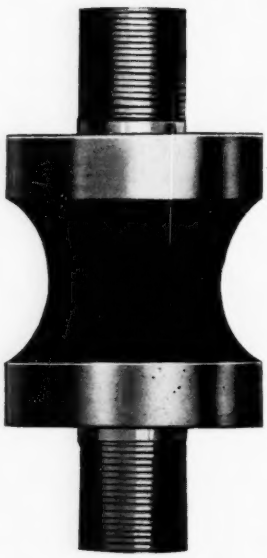
TY-PLY

for the Bonding of Rubber to Metal During Vulcanization



Ty-ply adhesive is a rubber derivative which sticks firmly to some metals, particularly the ferrous metals, **without brass-plating.** It bonds during vulcanization with the rubber or rubber-like compound. In common with most adhesives, it is most effective in thin films; hence only one coat or application is required.

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Synthetic Rubbers: A Review of Their Compositions, Properties, and Uses

Lawrence A. Wood, Ph.D.[1]

UNDERTAKEN some months past at the National Bureau of Standards, this review of work published during the last decade on synthetic rubbers has just been completed. Twenty-six commercial varieties of synthetic rubber-like materials of international repute are classified and discussed briefly in relation to the raw material used, the chemical reactions of manufacture, and the general conditions of polymerization or condensation. Also included is some discussion of their compounding and vulcanization characteristics and of the properties and uses of the products. Of particular value in this survey is a bibliography of 232 references covering the literature on the subject published from 1930 to date.

In substantially the same form, this survey will appear as Circular C427 of the National Bureau of Standards, and copies may be obtained in the near future from the Superintendent of Documents, Washington, D. C., at 10¢ a copy.

This literature review and bibliography together with nine consecutive articles of U. S. patent abstracts in INDIA RUBBER WORLD issues starting with May, 1936, and the current series abstracting German patents and appearing in our April, May, and July, 1940, issues, with other installments to follow, are believed to comprise a very complete review of the literature on synthetic rubber.

EDITOR'S NOTE.

SYNTHETIC rubber has been the dream of many during the century which has passed since Faraday first determined the carbon-hydrogen ratio in natural rubber, but it has completed only about a decade of commercial success. Each year of the past ten has seen an increase in the number of varieties, the quantity produced, and the number of applications.

This paper represents an attempt to summarize the facts relating to the existing varieties of synthetic rubber, to compare some of their properties as reported in previous publications, and to present a fairly complete bibliography of the modern literature on synthetic rubber. Previous scientific articles have been largely devoted to descriptions of single varieties or to discussions of limited phases of the work with respect to one variety. Because the data concerning the various synthetic rubbers have been reported almost entirely by observers in the laboratories of companies which were individually interested in the manufacture and sale of a particular variety, the figures in almost every case necessarily lack independent confirmation.

In most instances synthetic materials developed to replace those of vegetable or animal origin have been chemically and physically the same as the natural product. However this has not been true in the case of synthetic rubber. It seems now to be recognized that the desirable physical properties of rubber are not necessarily closely related to its chemical constitution, and since, in almost all its uses, its physical properties are of first importance, the effort to duplicate the chemical constitution of natural rubber has been abandoned.

Thirty years ago the term "synthetic rubber" meant a synthetic material physically and chemically indistinguishable from natural rubber. Since no material has been produced which fits this definition, the term has come to mean to most people a synthetic substance possessing the approximate properties of natural rubber (224). Several authors (4, 18, 19, 21, 225) have attempted to express such a definition in more exact terms. Others, following the older definition, have hesitated to use the phrase "synthetic rubber" and have taken refuge in the more indirect expressions "synthetic rubber-like material," "elastic synthetic," and "rubber substitute." Perhaps the most satisfactory solution would be the adoption of some single word such as "elastomer," as suggested by Fisher (7), but as yet no such word has met with general acceptance. The term "synthetic rubber" has been used so widely that it would probably be difficult to displace it.

The cheapest commercial synthetic rubber today costs

[1] United States National Bureau of Standards, Washington, D. C.

about twice as much as the natural product. Nevertheless in recent years certain countries, notably Germany and Russia, insisting upon economic self-sufficiency, have considered a high price paid within the country to be of little importance as compared with expenditures in foreign currency for natural rubber. Self-sufficiency in wartime has also been a factor of paramount interest to these governments (14, 125). These economic and political factors have influenced the scientific objectives and development in the different countries. In a free world market, only a superior synthetic rubber can justify a higher price. Whether or not in the future other countries including the United States will be moved by considerations of self-sufficiency to follow Germany and Russia remains to be seen.

Varieties of Synthetic Rubber

In conformity with the trend already mentioned the term "synthetic rubber" in this paper will be taken to mean merely a synthetic substance which has physical properties resembling those of natural rubber; that is, it can be stretched a considerable amount, let us say to an elongation of at least 300% and, when released, will quickly and forcibly retract to substantially its original dimensions. About 30 varieties of synthetic rubber are listed in Table 1 under the trade names used by the manufacturers. Of these, some are practically identical, and some are very closely related to others. They have been classified according to chemical composition into the six general types: (1) chloroprene polymers, (2) butadiene polymers (including co-polymers), (3) organic polysulphides, (4) isobutene polymers, (5) plasticized vinyl chloride polymers, and (6) dimethylbutadiene polymers. Familiar examples of each of these types are, respectively: (1) neoprene, (2) the German Buna rubbers, (3) "Thiokol," (4) Vistanex, (5) Koroseal, and (6) "methyl rubber." The discussion in the present paper follows this classification, but since the last type (6) is chiefly of historical interest, it is treated only briefly. The chemical constitution of almost all of the varieties listed in Table 1, together with that of natural rubber, is shown in Table 2.

In common with natural rubber, all types of synthetic rubber consist of atomic chains of very great length—giant molecules as they are sometimes called—built up by the repetition, usually thousands of times of some unit configuration. In all but the last two cases shown in Table 2 the long chains are built up by the polymerization, or linking together, of the molecules of liquids. In the process of formation of the polymer from the liquid monomer in each case the double bond attached to a carbon atom at the end of the molecule opens to form the necessary valence bond for attachment to the next unit. The organic polysulphide rubbers, which are illustrated by the last two types in Table 2 possess long chains formed not by polymerization, but by condensation. The atoms at the ends of two different molecules combine with each other, thus leaving the remaining radicals free to combine, and forming long chains by the repetition of the process (180). In none of the different varieties of synthetic rubber has the nature of the terminal group of the chain been definitely established. It comprises only a very small fraction of the total material and may be different in different chains of the same material.

The production of synthetic rubbers involves two steps—the manufacture of the monomer, and the polymerization or condensation reaction. The first step usually follows fairly common and well-understood reactions; the second step is much more empirical and less understood, but usually involves the use of a catalyst and the control of temperature and pressure.

One of the most important improvements during the past few years has been the adoption, in many cases, of polymerization in emulsion. The monomer is emulsified in a liquid, usually water, and the product is a suspension similar to the latex of natural rubber. Another important advance was the discovery and development of co-polymerization. This is a process involving the simultaneous polymerization of two or more liquids and yielding a product in which a single chain contains units of both configurations. The co-polymers of butadiene with styrene and of butadiene with acrylo-nitrile are the best-known examples.

Prolonged research (28) has failed to find a cheap source of supply for the manufacture of isoprene or to produce from it a polymer with physical properties close

TABLE 1. VARIETIES OF SYNTHETIC RUBBER

Name	Type	Remarks	Reference	Manufacturer	Country of Origin
Buna 85	butadiene polymer	molecular weight about 85,000	(128)	I. G. Farbenindustrie	Germany
Buna 115	butadiene polymer	molecular weight about 115,000	(128)	I. G. Farbenindustrie	Germany
Buna N*	butadiene co-polymer	co-polymer with acrylo-nitrile; now called Perbunan	(128)	I. G. Farbenindustrie	Germany
Buna S	butadiene co-polymer	co-polymer with styrene	(128)	I. G. Farbenindustrie	Germany
Buna SS	butadiene co-polymer	co-polymer with styrene—higher styrene content than Buna S	(129)	I. G. Farbenindustrie	Germany
DuPrene*	chloroprene polymer	now called neoprene	(60)	E. I. du Pont de Nemours & Co., Inc.	United States
Ethanite	organic polysulphide	similar to "Thiokol" A	(171, 182)	Belgian Cracking Co.	Belgium
Flamenol	plasticized vinyl chloride polymer			General Electric Co.	United States
Ker	butadiene polymer		(126)	Stomil Co.	Poland
Korogel	plasticized vinyl chloride polymer	highly plasticized Koroseal	(210)	B. F. Goodrich Co.	United States
Koroseal	plasticized vinyl chloride polymer		(212)	B. F. Goodrich Co.	United States
Levulkan*	butadiene co-polymer	now called Buna SS	(129)	I. G. Farbenindustrie	Germany
Methyl rubber B†	dimethyl butadiene polymer	sodium used as catalyst	(33)	Bayer & Co.	Germany
Methyl rubber H†	dimethyl butadiene polymer	cold polymerization	(33)	Bayer & Co.	Germany
Methyl rubber W†	dimethyl butadiene polymer	hot polymerization	(33)	Bayer & Co.	Germany
Neoprene	chloroprene polymer		(60)	E. I. du Pont de Nemours & Co., Inc.	United States
Mustone	chloroprene polymer		(20)	Umeno Institute	Japan
Oppanol	isobutene polymer		(203)	I. G. Farbenindustrie	Germany
Perbunan	butadiene co-polymer	co-polymer with acrylo-nitrile	(128)	I. G. Farbenindustrie	Germany
Perbunan Extra	butadiene co-polymer	co-polymer with acrylo-nitrile—higher nitrile content than Perbunan	(128)	I. G. Farbenindustrie	Germany
Perduren	organic polysulphide		(183)	I. G. Farbenindustrie	Germany
Resinit*	organic polysulphide		(109)		Russia
SKA	butadiene polymer	from petroleum	(116)		Russia
SKB	butadiene polymer	from alcohol	(109)		Russia
Sovprene	chloroprene polymer		(63)		Russia
"Thiokol"	organic polysulphide		(180)	Thiokol Corp.	United States
Thionite	organic polysulphide		(172)	Furukawa Electric Co.	Japan
"Vinylite" Series V	plasticized vinyl chloride co-polymer	co-polymer with vinyl acetate	(219a)	Carbide & Carbon Chemicals Corp.	United States
Vistanex	isobutene polymer		(206)	Standard Oil Co. of N. J.	United States
Vulcaplas	organic polysulphide		(176)	Imperial Chemical Industries, Ltd.	England

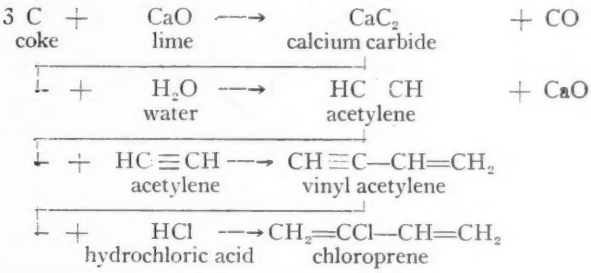
*This term is now commercially obsolete.
†These synthetic rubbers were manufactured commercially only during 1915-1918.

to those of natural rubber. Consequently efforts in these directions have been almost completely abandoned, and all the commercial synthetic rubbers differ chemically from natural rubber. Between 1915 and 1918 the Bayer plant in Germany produced about 2,500 tons of rubber from dimethyl butadiene (33). The product, called "methyl rubber," has not, since then, retained any commercial importance. With these exceptions and possibly a few others, all the materials shown in Tables 1 and 2 are at present in commercial production, although some are produced in very limited quantities. From the diversity of chemical constitutions shown by the example in Table 2 one may conclude that the physical properties ordinarily associated with rubber are not limited to one group of related chemical compounds and that there are probably many more undiscovered types of synthetic rubber.

Chloroprene Polymers

The preparation and properties of the chloroprene polymers have been described quite extensively in the scientific literature. Neoprene, formerly called DuPrene, is the leading representative of this type and is widely used in the United States and in England. The Russian chloroprene polymer is called Sovprene (63).

The chemical reactions (60, 71) involved in the manufacture of chloroprene are indicated by the following equations:

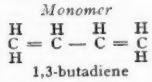
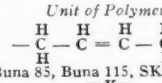
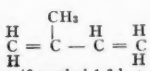
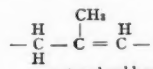
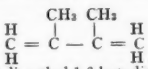
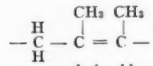
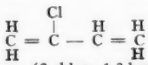
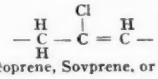
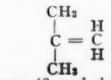
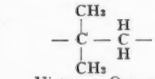
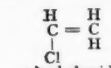
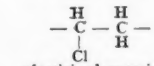


Chloroprene polymerizes much more rapidly than butadiene and, with a few unimportant exceptions, somewhat more rapidly than any of the derivatives of butadiene (73). If the polymer is removed when polymerization is about one-third complete, it is found to possess quite different mechanical properties from those of the completely polymerized material (60). The former product, the α-polymer, resembles unvulcanized rubber; while the latter, the μ-polymer, resembles vulcanized rubber. The commercial varieties of neoprene correspond to the -polymer and are made by the polymerization of chloroprene under different conditions. Neoprene G, for example, is an emulsion polymer (89). A very small amount of a stabilizing material, commonly phenyl-β-naphthylamine, is usually added to neoprene after polymerization (64, 93). The stabilizer prevents continued polymerization, or more particularly cross-linking or cyclization, which would cause a stiffening of the neoprene during storage. Plasticizers are frequently added in small amounts for the purpose of enabling the material to be processed more conveniently with the usual rubber machinery (83).

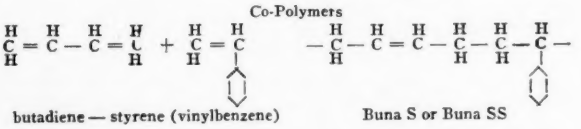
When neoprene is heated, it undergoes a permanent change in physical properties similar to that involved in the vulcanization of rubber. The chloroprene polymers are unique among rubbers, synthetic or natural, in that this process can occur without the addition of other materials. In commercial practice, however, it is found more desirable to add a number of compounding ingredients. Several of the metallic oxides (83, 88), such as magnesium oxide, zinc oxide, and litharge, function as vulcanizing agents, rather than sulphur, which, when used, acts as an accelerator. Many of the organic accelerators used with natural rubber are not effective with neoprene, but catechol and some similar substances are said to be promising substitutes (86, 90). The addition of carbon black, which is usually found desirable, makes a stiffer compound, but contrary to its effect with natural rubber, it

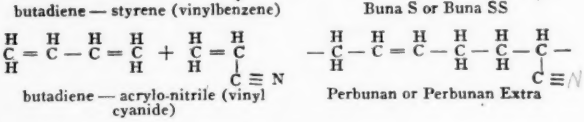
TABLE 2. CHEMICAL STRUCTURES OF DIFFERENT VARIETIES OF SYNTHETIC RUBBER

Simple Polymers

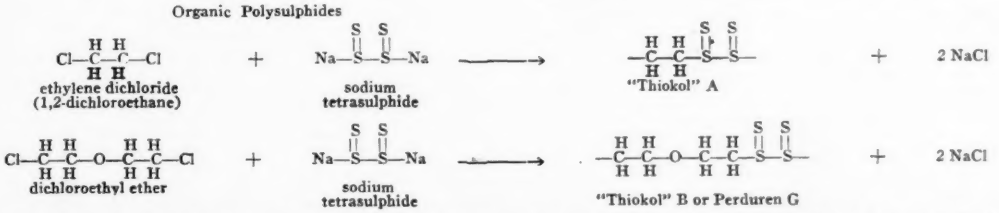
Monomer	*Unit of Polymer*
 1,3-butadiene	 Buna 85, Buna 115, SKA, SKB. or Ker
 isoprene (2-methyl-1,3-butadiene)	 natural rubber
 2,3-dimethyl-1,3-butadiene	 methyl rubber
 chloroprene (2-chloro-1,3-butadiene)	 néoprene, Sovprene, or Mustone
 isobutene (2-methyl-1-propene)	 Vistanex, Oppanol
 vinyl choride	 plasticized materials: Ko.oseal, Korogel, or Flamenol

Co-Polymers





Organic Polysulphides



Notes: The bonds between carbon and hydrogen are not indicated. The structural formulas are not intended to give any indications regarding stereo-isomerism. Fuller (37) has recently suggested a ring structure in the organic polysulphides.

does not increase the tensile strength. It has not been found possible to vulcanize neoprene to a state corresponding to ebonite, or hard rubber. Compounding materials are mixed with neoprene by means of the usual rubber machinery, but its behavior on milling is somewhat different. Neoprene E and the types previously produced appear to be unaffected by mastication; the softening which occurs is caused merely by the elevation of temperature. The newer types, G, GW, and GN, may be substantially softened by mastication (93).

Butadiene Polymers

Butadiene, either alone or in combination with other substances, is the source of almost all the synthetic rubber manufactured in Europe. Butadiene, a gas at temperatures about –5° C., is being manufactured by a number of different methods. One method (133) involves the pyrolysis ("cracking") of petroleum, especially the higher-boiling constituents. Under the proper conditions the process yields butadiene directly. The crude butadiene is then subjected to purification. This process is used in the manufacture of the Russian rubber called SKA (116), and it is reported to be the one which the Standard Oil Co. is planning to use in the United States for the manufacture of a rubber similar to Perbunan (112, 113, 115a, 117). A dehydrogenation of some of the lower-boiling constituents of petroleum has also been described, but not yet put into commercial practice (134, 135).

In another important method, alcohol is converted into butadiene by a reaction (130) indicated as follows:

$$\underset{\text{alcohol}}{2\,C_2H_5OH} \longrightarrow \underset{\text{butadiene}}{CH_2{=}CH{-}CH{=}CH_2} + 2H_2O + H_2$$

The butadiene used in the manufacture of the Russian rubber SKB is prepared in this manner from alcohol obtained by the fermentation of grain or potatoes (109, 114, 131).

The polymerization of an impure material yields a product of low molecular weight, presumably because the formation of long chains is interrupted by the impurity. It is very difficult to obtain butadiene of high purity from petroleum products, especially when they are the products of cracking operations, or from agricultural products, particularly when they are obtained by fermentation. This fact is one of the major causes of difficulty and expense in making butadiene from these sources.

One possible process for the manufacture of butadiene from acetylene is similar to that already given for the manufacture of chloroprene except for the substitution of hydrogen for hydrochloric acid in the last step. However the reactions of the process (123, 140) actually used most extensively in Germany are indicated by the following equations:

$$\underset{\text{coke}}{3\,C} + \underset{\text{lime}}{CaO} \longrightarrow \underset{\text{calcium carbide}}{CaC_2} + CO$$

$$\underset{\text{water}}{H_2O} + CaC_2 \longrightarrow \underset{\text{acetylene}}{HC{\equiv}CH} + CaO$$

$$\underset{\text{water}}{H_2O} + HC{\equiv}CH \longrightarrow \underset{\text{acetaldehyde}}{CH_3{-}CHO}$$

$$CH_3{-}CHO + CH_3{-}CHO \longrightarrow \underset{\text{aldol}}{CH_3{-}CHOH{-}CH_2{-}CHO}$$

$$2\,H + CH_3{-}CHOH{-}CH_2{-}CHO \longrightarrow \underset{\substack{\text{butanediol or}\\ \text{butylene glycol}}}{CH_3{-}CH(OH){-}CH_2{-}CH_2OH}$$

$$CH_3{-}CH(OH){-}CH_2{-}CH_2OH \longrightarrow \underset{\text{butadiene}}{CH_2{=}CH{-}CH{=}CH_2} + 2\,H_2O$$

Although long, the process is said to be free from side reactions and to yield butadiene of high purity.

The first reaction is carried out in a furnace for which large amounts of electrical energy are required (110). The cost of the electrical energy is probably one of the largest items in the whole process. In another process reported to be in use in Germany the acetylene is said to be extracted from coke-oven gases.

For the products known as Buna 85, Buna 115, SKA, and SKB, polymerization of butadiene is carried out with metallic sodium as the catalyst. Emulsion polymerization is used for Buna S and Perbunan. The co-polymers Buna S and Perbunan contain 20 to 40% of styrene (139) or acrylo-nitrile (138), respectively. Polymerization, in addition to the formation of the long chains, leads to a certain amount of cross-linking or cyclization. The continuation of cyclization during storage of the raw material is prevented by the addition of a very small amount of a stabilizer; phenyl-β-naphthylamine is almost always used (128).

Buna S and Perbunan, in the uncompounded state, are somewhat stiffer than natural rubber and behave somewhat differently during processing on the usual rubber machinery. Heating Buna S to a temperature of 130 to 150° C. for one hour or two hours in the presence of air produces a temporary change known as thermal oxidative softening which is of very considerable importance in the technology of this material (142). Since such a treatment is not effective with Perbunan, various softeners are usually added to facilitate processing.

Vulcanization of the butadiene polymers is carried out with sulphur as the vulcanizing agent together with zinc oxide and organic accelerators. With sufficient sulphur, compounds of the ebonite type can be made (157). In these respects the butadiene polymers are similar to natural rubber and differ from neoprene. The ebonite made from the Buna rubber is said to soften at a higher temperature than that made from natural rubber (147).

Organic Polysulphides

The condensation reactions of organic dihalides with sodium tetrasulphide indicated by the equations shown at the end of Table 2 are typical of a large number of reactions (180, 183) for obtaining substances which, although bearing no chemical relation to natural rubber, conform to the definition of synthetic rubber already given. Certain products of this type are given the trade name "Thiokol" in the United States and Perduren in Germany. In each unit of these compounds two sulphur atoms are part of the main chain; while the two others are attached to them and are not part of the main chain. If the latter two sulphur atoms are removed by chemical means (180), "Thiokol" A yields an inextensible product, but "Thiokol" B yields material which is still extensible and is sold as "Thiokol" D (183). Perduren G is similar to "Thiokol" B, while Perduren H is formed by the reaction of di(chloroethyl)formaldehyde acetal with sodium tetrasulphide (31, 183). Perduren L is a mixture of Perduren and Perbunan. A Japanese product, Thionite, is obtained from the reaction of ethylene diglycoside with sodium tetrasulphide (172). Vulcaplas is an organic polysulphide made in England by the reaction of glycerol dichlorohydrin with sodium tetrasulphide or similar sulphides (176). The raw materials from which many of the polysulphide rubbers are made are relatively cheap. The sodium tetrasulphide is obtained from the reaction of caustic soda and sulphur; the organic dichlorides are produced from common organic compounds and chlorine. The chlorine is obtained from salt, and many organic compounds can be obtained from natural gas.

The polysulphide rubbers can be vulcanized, like neoprene, with the metallic oxides as vulcanizing agents and sulphur as an accelerator. The chemical reaction must be of a type somewhat different from that in the vulcanization of natural rubber, where there is a decrease in the number of double bonds in the long-chain molecules; for the polysulphide rubbers an oxidation with the evolution of water and an increase in chain length have been suggested (180). Fillers are usually required for the development of satisfactory tensile strength. Carbon black is most frequently employed for this purpose.

The polysulphide rubbers, particularly "Thiokol" A, are by far the most resistant of the synthetic rubbers to the effects of certain liquids such as solvents and oils which are injurious to natural rubber. Their chief disadvantages are a rather strong, unpleasant odor and some deficiency in mechanical properties. The odor has, however, been considerably reduced and rendered less objectionable in some of the newer varieties and practically eliminated in others. Cold flow is a mechanical deficiency which can be reduced somewhat by increase of the amount of filler or by mixture with other types of rubber, natural or synthetic. "Thiokol" A is recommended for use only at temperatures between —10° C. and +70° C., but many of the other types are serviceable from about —40° C. to +80° C. (190).

Isobutene Polymers

The polymerization of isobutene, a hydrocarbon obtainable from petroleum, gives a synthetic rubber which was developed in Germany under the name Oppanol (203). Further research has continued in the United States where the product is sold under the name Vistanex (206). The polymerization is conducted at low temperatures with substances like boron fluoride or aluminum chloride as catalysts and is extremely rapid, often being completed in a fraction of a second (200, 207). The molecular weight of the product is controlled by the temperature at which polymerization occurs. For a temperature of —10° C. the molecular weight, as measured by the Staudinger viscosity method, is about 10,000; for a temperature of —95° C., about 250,000. Isobutene polymers with molecular weights as high as 400,000 can be prepared in this manner (206).

Since the vulcanization of natural rubber is usually thought to be connected with a chemical reaction involving double bonds in the long-chain molecules, it is not surprising to note the failure of all attempts (206) to vulcanize isobutene polymers, which contain no double bonds.

Some writers (21, 128) prefer to use vulcanizability as one of the criteria for the classification of a material as a synthetic rubber. Consequently, contrary to the practice of the present paper, they do not include among synthetic rubbers the isobutene polymers, or the plasticized vinyl chloride polymers, discussed in the following section. Isobutene polymers maintain their elastic properties at temperatures as low as —50° C. and as high as +100° C. (32, 194, 204).

Plasticized Vinyl Chloride Polymers

Polymerized vinyl chloride is ordinarily obtained as an amorphous white powder, but by the application of pressure it can be converted at 120° C. into a transparent brittle solid, possessing a very small extensibility (219). By itself it is not rubber-like; it has been found, however, that by the addition of a suitable liquid it may be plasticized to give an extensible material with an increase in the ultimate elongation up to about 500% (212). The amount of tricresyl phosphate, the plasticizer most commonly employed, may be as high as 60% of the total. In the United States, Koroseal and Flamenol are the most widely used varieties of plasticized vinyl chloride polymers. The vinyl chloride polymers, like the isobutene polymers, contain no double bonds, as can be seen in Table 2. Similarly, no method for their vulcanization has been discovered. No increase in tensile strength has been found when fillers are mixed with plasticized vinyl chloride polymers (212). Since a reversible softening of the material occurs when it is heated, service temperatures above 77° C. are not recommended (215).

Fuoss (219) has given an equation for the calculation of the specific volume V, in cc/g, of mixtures of polymerized vinyl chloride and tricresyl phosphate. His equation is equivalent to

$$V = 0.706 + 0.155\ P$$

where P is the weight of tricresyl phosphate expressed as a fraction of the total. A mixture of 40% tricresyl phosphate with polymerized vinyl chloride was found (217) to have a specific heat of 0.417 cal/g between 28° and 59° C. and a thermal conductivity of $1.42 \pm 0.07 \times 10^{-3}$ j·sec^{-1}·cm^{-1}·deg^{-1} at between 50° and 100° C.

Also falling under this classification are the co-polymers of vinyl chloride and acetate, white powders which may be plasticized so as to exhibit rubber-like characteristics. The commercial products are known as "Vinylite" series V resins in this country and can be made to have an elongation of 300% with a tensile strength of 3,000 pounds per square inch depending upon the plasticizer and the amount used (219a). The material is resistant to oxidation, oils, and chemicals, although the plasticizer used imposes certain limitations on its chemical inertness.

Both the simple polymers and the co-polymers of this type, when plasticized, show a much slower recovery from deformation than does vulcanized rubber; times of seconds or minutes are sometimes required. There is, therefore, some hesitation about classifying them as synthetic rubbers.

Comparison of Properties

Densities

Values of the densities of a number of different varieties of synthetic rubber are shown in Table 3. The temperature of the observation was seldom specified, but may be presumed to have been between 20 and 25° C. It will be noted, as might be expected, that the varieties consisting of hydrocarbons possess the lowest densities; while the varieties containing chlorine: namely, neoprene and Koroseal, and those containing sulphur: namely, the "Thiokols" and Perdurens, have higher densities.

TABLE 3. DENSITIES OF UNVULCANIZED MATERIALS

Material	Density G/CC	Reference
Natural rubber	0.911	(223)
μ-polymer of chloroprene	1.23	(60)
Neoprene	1.25	(93)
Perbunan	0.96	(128)
Perbunan Extra	0.97	(128)
Methyl rubber (20° C.)	0.9292	(33)
"Thiokol" A	1.60	(190)
"Thiokol" D	1.34	(190)
"Thiokol" DX	1.39	(190)
"Thiokol" F	1.38	(190)
Perduren G	1.68	(31)
Perduren H	1.56	(31)
Perduren L	1.17	(31)
Vistanex HM (25° C.)	0.9125	(202)
Vinyl chloride polymer, 0% plasticizer	1.42	(219)
Vinyl chloride polymer, 30% plasticizer	1.33	(219)
Vinyl chloride polymer, 60% plasticizer	1.25	(219)

Refractive Indices

The values of refractive index which have been reported are shown in Table 4.

TABLE 4. REFRACTIVE INDICES OF UNVULCANIZED MATERIALS

Material	Temp. °C.	n_D	Reference
Natural rubber	25	1.5190	(227)
μ-polymer of chloroprene	20	1.5512	(60)
Neoprene	25	1.5580	(51)
Neoprene	30	1.5562	(51)
Perbunan	25	1.5213	(51)
Perbunan	30	1.5562	(51)
Methyl rubber	20	1.525	(33)
Vistanex HM	25	1.5089	(209)
Vistanex HM	10	1.5131	(209)
Components of plasticized vinyl chloride polymers			
Vinyl chloride polymer (unplasticized)	40	1.565	(219)
Tricresyl phosphate (plasticizer)	40	1.5494	(219)

Identity Periods Along the Fiber Axes

The X-ray patterns obtained, when many of the varieties of synthetic rubber are stretched, indicate the existence of a fiber structure during stress. Identity periods along the fiber axes have been reported as follows:

Material	Angstrom Units	Reference
Natural rubber	8.20	(226)
μ-polymer of chloroprene	4.81	(60, 73, 75)
"Thiokol" A	4.32 or 8.64	(37, 38)
Oppanol	18.50	(196)
Vistanex	18.63	(199)
Vinyl chloride polymer (unplasticized)	5.0	(37)

Electrical Properties

The published data on the electrical properties of the existing varieties of synthetic rubber are rather incomplete. The presence of polar groups—chlorine in neoprene and Koroseal, and the nitrile group in Perbunan—is responsible for relatively high values of conductivity and dielectric constant in the types mentioned. The following values have been observed (102) at 28° C. and are said to be representative of neoprene compounds containing only enough added ingredients to insure proper vulcanization: dielectric constant at 1,000 cycles per second 7.5; power factor at 1,000 cycles per second 300 x 10^{-4}; and d.c. conductivity 10^{-12} mho cm^{-1}. The electrical properties of Buna 85, Buna 115, and Buna S are nearly alike. Values reported (156) for a temperature of 20° C. are: dielectric constant at 50 cycles per second 2.9; power factor at 50 cycles per second 7 x 10^{-4}; and conductivity 10^{-15}—10^{-14} mho cm^{-1}. Perbunan, with its polar nitrile group, has a dielectric constant of the order of 15 and a conductivity of 10^{-7}—10^{-6} mho cm^{-1} (158).

The same author (153) has more recently reported values for Buna S and Buna SS at 20° C. as: dielectric constant at 50 cycles per second 4.3 to 4.7; and power factor at 50 cycles per second 170 x 10^{-4}. In the same work the conductivity of Perbunan was given as between 10^{-10} and 10^{-8} mho cm^{-1}. The dielectric constant of a "Thiokol" compound has been reported as 4.60 (58). Scott (205) has made some electrical measurements on Vistanex at 25° C. The dielectric constant at 1,000 cycles per second and at 100,000 cycles per second was found to be 2.29. The power factor at 1,000 cycles per second was measured at 1.5 x 10^{-4} and at 100,000 cycles per second as 3.4 x 10^{-4}. The d.c. conductivity one minute after the application of the potential was less than 20 x 10^{-18} mho cm^{-1}. The electrical properties of vinyl chloride polymers, plasticized with tricresyl phosphate, have been the subject of extensive studies by Fuoss (216, 217, 218, 219) and by Davies and Busse (213). The results obtained are too detailed and complex for summary here, but a few values selected from one paper (219), reporting measurements at 40° C., are given below.

	Dielectric Constant. 60 c.p.s	Dielectric Constant. 1,000 c.p.s	D.C. Conductivity mho cm^{-1}
0% Plasticizer	3.435	3.338	0.1 x 10^{-12}
30% Plasticizer	7.56	5.72	2.8 x 10^{-12}
60% Plasticizer	10.18	9.65	323. x 10^{-12}

Tensile Strengths

The maximum reported values of the tensile strengths with the corresponding elongations for different kinds of synthetic rubber are given in Table 5. Since the data were necessarily obtained from a number of sources, the conditions of measurement may not have been strictly comparable in all cases. In some instances the figures have been rounded off from those actually observed. The figures refer, respectively, to the unvulcanized material, to a vulcanized compound containing no fillers, and to a vulcanized compound containing approximately the optimum amount of carbon black for maximum tensile strength in each case.

A study of the table reveals a number of interesting facts. The major increase in tensile strength of natural rubber occurs on vulcanization; the effect of the addition of carbon black is to increase the tensile strength somewhat and to stiffen the rubber quite considerably. No synthetic rubber compounds have been made with tensile strengths exceeding those of the best carbon-black compounds of natural rubber. Neoprene shows no increase in tensile strength with the addition of carbon black, but undergoes a stiffening. "Thiokol," very weak in the unvulcanized form, is markedly strengthened by vulcanization; by far the major increase in tensile strength, however, occurs on the addition of carbon black. Carbon black is also the major factor in obtaining high tensile strengths with Perbunan and the other types of Buna rubber, as well as with methyl rubber. Vistanex shows an increase of tensile strength with increasing molecular weight; the figures given are presumably for molecular weights of the order of 100,000 and 200,000, respectively. Koroseal is found to decrease in tensile strength and to increase in the corresponding elongation, as the amount of plasticizer is increased.

TABLE 5. MAXIMUM TENSILE STRENGTHS AND CORRESPONDING ELONGATIONS

	Unvulcanized			Vulcanized Pure-Gum Compound			Vulcanized Carbon-Black Compound		
	Tensile Strength kg/cm^2	Elongation %	Reference	Tensile Strength kg/cm^2	Elongation %	Reference	Tensile Strength kg/cm^2	Elongation %	Reference
Natural rubber	25	1,200	(228)	290	710	(33)	350	650	(33)
Neoprene	30	1,100	(86)	300	820	(86)	290	760	(91)
Buna 85	..	....	....	..	....	....	175	600	(147)
Buna 115	..	....	....	..	....	....	200	700	(147)
Buna S	..	....	....	..	....	....	280	650	(147, 156)
Perbunan	..	....	....	150	900	(128)	320	600	(128)
Methyl rubber W	..	....	....	30	510	(33)	170	530	(33)
Methyl rubber H	..	....	....	90	240	(33)	160	300	(33)
"Thiokol" A	..	....	....	..	....	....	60	370	(183, 190)
"Thiokol" D	7	570	(179)	35	750	(190)	120	610	(179)
Vistanex MM (Oppanol B100)	20	1,000	(201)	Not Vulcanizable			Not Vulcanizable		
Vistanex HM (Oppanol B200)	60	1,000	(32, 201)	Not Vulcanizable			Not Vulcanizable		
Koroseal 0% plasticizer	400	2	(212)	Not Vulcanizable			Not Vulcanizable		
Koroseal 30% plasticizer	270	170	(212)	Not Vulcanizable			Not Vulcanizable		
Koroseal 60% plasticizer	70	500	(212)	Not Vulcanizable			Not Vulcanizable		
"Vinylite" V 33% plasticizer	210	300	(219a)	Not Vulcanizable			Not Vulcanizable		

Swelling in Liquids

The higher cost of synthetic rubbers is offset in a number of cases by the superiority of some of their properties in comparison with those of natural rubber. Foremost among these properties at present is resistance to the effects of certain liquids, particularly petroleum products. Table 6 presents the results of swelling measurements for natural and synthetic rubbers in a number of liquids in which the swelling of natural rubber is particularly large. The figures have, in some cases, been rounded off from those actually observed. Since the data were necessarily obtained from a number of sources, the values, like those for tensile strength, may not be strictly comparable in all cases. However the figures suffice to give an idea of the orders of magnitude involved and of the relative swelling of different types of synthetic rubber.

TABLE 6. SWELLING OF VULCANIZED COMPOUNDS IN LIQUIDS
Volume Increase, in %, after Immersion for Eight Weeks at Room Temperature

	Natural Rubber	Neoprene	Perbunan	Perbunan Extra	"Thiokol" A	"Thiokol" D	"Thiokol" DX and F
Light gasoline (benzine)	160	..	20	20	0	..	..
Gasoline	230	8	40	..	0	3	3
Kerosene	..	60	..	..	0	2	2
Diesel oil	120	..	15	15	..	..	..
Fuel oil	..	..	..	..	0	10	10
Lubricating oil	..	40	−4	..	0	1	1
Paraffin oil	140	..	3	..	..	..	..
Transformer oil	150	..	5	..	..	..	..
Acetone	..	25	110	110	..	..	9
Benzene	370	160	210	140	7	150	90
Carbon tetrachloride	670	160	220	120	0	40	30
Ethyl ether	130	50	50	..	..	..	..
Linseed oil	100	..	20	..	..	1	1
Turpentine	300	90	50	30	0	..	..
References	(156)	(96)	(31,49,156)	(31)	(190)	(190)	(190)

The first eight liquids are petroleum products, in the handling of which synthetic rubber has been found particularly useful. Unfortunately the common names used for the liquids are insufficient to describe their chemical compositions, which may vary widely with place of origin and subsequent treatment. Since the swelling is determined largely by the chemical composition of the liquid, such a wide variation of values is obtained that the figures quoted for these products are less significant than those for the others. Neoprene, for example, may swell in different lubricating oils at 100° C. as much as 120% or as little as 12% (95). Correlation is found with a figure which represents to some extent the ratio of aliphatic to aromatic constituents in the oil.

For many uses loss of tensile strength on swelling is an even more serious factor than the actual swelling. Very little information on this subject has been published. Usually the tensile strength of a synthetic rubber shows less impairment than that of natural rubber, even when the amounts of swelling are not widely different. Synthetic compounds can be made which are greatly superior to natural rubber in that there is much less extraction of soluble material by liquids in contact with them.

Aging Properties

The second important general superiority of many synthetic rubber compounds is their resistance to deterioration or aging under conditions which impair the utility of natural rubber. Some of these conditions are exposure to the oxygen of the atmosphere, to ozone from electrical discharges, or to light, especially direct sunlight (102, 187) or to high temperatures (102, 147, 162). Flex-cracking can also be considerably reduced or eliminated in many cases (91, 128).

Since the usual deterioration of natural rubber is thought to be connected with an oxidation reaction involving the double bonds, it is not surprising to note the superiority, in this regard, of isobutene polymers (206) and plasticized vinyl chloride polymers (212), which contain no double bonds.

Permeability

Synthetic rubber compounds can be made which show a greatly decreased permeability to liquids and gases as compared with natural rubber. Part of the advantage is due to the absence of proteins and other non-hydrocarbon constituents, and part to differences in structure. The diffusion constant for water is defined by Taylor, Herrmann, and Kemp (57) as the number of grams of water-vapor passing through one square centimeter of the material one centimeter thick in one hour under a differential pressure of one millimeter of mercury. The values which they found are as follows:

Soft vulcanized rubber	6.66×10^{-8} g·hr^{-1}·cm·cm^{-2}·(mm of mercury)$^{-1}$
Ebonite	1.51×10^{-8}
Neoprene, vulcanized	2.63×10^{-8}
"Thiokol" A	0.22×10^{-8}
Plasticized vinyl chloride polymer	3.85×10^{-8}

Roelig (153) has given corresponding figures for the Buna rubbers. Buna SS has a lower permeability than natural rubber, especially when the unvulcanized materials are compared.

The permeability to gases, of several types of synthetic rubber, has been measured by Sager and Sucher (99), by Sager (189), and by Barrer (11). "Permeability" is defined by the former observers as the number of cubic centimeters per minute passing through a membrane one centimeter thick and one square centimeter in cross-sectional area, when it separates air at atmospheric pressure from the gas at a pressure of 30 mm. of water above atmospheric. The mean values which they obtained for hydrogen at 25° C. are as follows:

Rubber	24×10^{-6} cm^3 · min^{-1} · cm · cm^{-2}
Neoprene	4.2×10^{-6}
"Thiokol" B	0.17×10^{-6}
"Thiokol" D	1.5×10^{-6}

Buna S, Buna 85, and Buna 115 possess about the same permeabilities to air as natural rubber does, but Perbunan vulcanizates show a permeability less than half as large (147, 153).

Combustion

Since a very appreciable fraction of the weight of neoprene and Koroseal consists of chlorine, these materials show a greater resistance to burning than natural rubber. They burn when a flame is applied, but combustion usually ceases when the flame is removed (91, 212).

Abrasive Characteristics

Losses from abrasion measured in the laboratory are reported to be about the same for the best compounds of Buna 85 and Buna 115 as for a high-grade tire tread of natural rubber (147). With Buna S the abrasion is said to be about 25% less and with Perbunan about 40% less. The figures refer to a material containing no softener or plasticizer. With the addition of the plasticizers which are necessary for working the materials on ordinary rubber machinery, as is done in the manufacture of tires on a plant scale, the advantages in resistance to abrasion are considerably reduced. It is stated that road tests in which 40 test cars traveled about 750,000 miles showed losses from abrasion for tires of Buna S and Perbunan to be about 10% less and about 30% less, respectively, than for tires of natural rubber (161). More recently the figure of 25 to 35% has been given as the result of a long series of road tests on tires of Buna S (128). The

other varieties of synthetic rubber are either inferior to natural rubber in resistance to abrasion, or only slightly superior.

Energy Absorption

The absorption of energy by synthetic rubber during repeated stresses is generally greater than that for natural rubber (84, 102, 103, 104, 154, 160). This quality, a disadvantage under many conditions, especially where it may lead to overheating of the rubber as in tires, is desirable in cases where the rapid damping of vibrations is important.

Latex Characteristics

As has been mentioned, emulsion polymerization yields a latex similar to that of natural rubber. The latices of neoprene (60, 105a, 106) and Buna S (164) contain particles which are smaller than those in the latex of natural rubber and are more nearly uniform in size. Furthermore they contain no organic impurities subject to putrefaction through bacterial action. Consequently they are often used where the penetration of the latex into fine pores is of importance or where decomposition must be avoided. The latex of "Thiokol" A contains particles larger than those of natural rubber (193).

Electrical Conductivity

The electrical properties of some types of synthetic rubber, notably Vistanex (205) and Buna S (153, 156), may be superior to those of natural rubber. The presence of polar groups, as already mentioned, is responsible for relatively high values of conductivity in neoprene, Perbunan, and Koroseal. This property may sometimes be turned to advantage as, for example, in the dissipation of undesired static charges.

Applications of Synthetic Rubber

The applications of synthetic rubbers, like those of natural rubber, are so many and varied that it is impossible to do more than list some of the general fields and to illustrate with a few specific examples. In general there are possibilities for the use of synthetic rubber in every application of natural rubber and in a number of additional fields from which natural rubber is barred by some of its deficiencies. No single type of synthetic rubber posssesses outstanding advantages in all fields. However for any given application it is usually possible to select a particular variety of synthetic rubber which excels natural rubber in some property of importance for that application. Possibly no individual synthetic rubber will ever have such a wide field of application as does natural rubber, but collectively synthetic rubbers possess a marked advantage over natural rubber by reason of the diversity of properties which they afford.

The commercial applications of synthetic rubber throughout the world today are determined in part by considerations of national economy and in part by those of the inherent characteristics of the different varieties. More natural rubber is used in vehicle tires and tubes than in any other single field of application. Where considerations of national economy enter, notably in Germany and in Russia, synthetic rubber is used very extensively for this purpose. Elsewhere, however, its higher cost has thus far prevented anything more than experimental applications in this field, where the deficiencies of natural rubber are not particularly noticeable.

Buna S is at present the type of synthetic rubber in general use in Germany for tires; while Perbunan is generally reserved for those uses where resistance to the effects of liquids is important (128). There are several important factors dictating the choice of Buna S rather than Perbunan for tires. It is cheaper to produce, and plasticization with hot air is possible. In adhesive properties Buna S is superior to Perbunan, although still inferior to natural rubber. Natural rubber, because of its greater adhesiveness and smaller energy absorption, is sometimes used for the carcass of a tire in which Buna S is used for the tread. A direct bonding between the two, without the use of intermediate material, is possible, but direct bonding is impossible between Perbunan and natural rubber. The lack of sufficient adhesiveness leads to difficulties in building tires with a large number of plies without the use of natural rubber. The manufacture of four-ply and six-ply passenger car tires exclusively from Buna S is said to be on a satisfactory basis, but some problems connected with the manufacture of heavy truck tires apparently have not yet been completely solved (111, 128).

Each of the properties in which synthetic rubber may be superior to natural rubber, as mentioned in the preceding section, suggests possible applications for the former. Resistance to the effects of liquids, particularly hydrocarbons, is responsible for the very extensive use of synthetic rubber in hose and tubing especially in the handling of petroleum products. In oil fields, refineries, tankers, filling stations, and in the automobile itself, petroleum products now usually pass through hose and tubing of synthetic rubber and into tanks which are sealed with it. Elsewhere in the automobile are many other parts which may come in contact with oil. More of them every year are being made of synthetic rubber or jacketed with it. The number of such parts at present on some cars is said to be as high as thirty or forty. For use in contact with oils, grease, fats, and many chemicals, mountings for vibration absorption, conveyer belts, tires for industrial trucks, gaskets, and sealing devices are being made of synthetic rubber. Additional examples are shoe soles and heels, aprons, gloves, and similar articles for personal use under the same conditions. The relative stability of synthetic rubbers toward certain liquids is responsible for their increasing use in printers' rolls and blankets, engraving plates, and similar articles. Tubes for spraying equipment for paints and lacquers utilize synthetic rubber to advantage. Neoprene, "Thiokol," and Koroseal are extensively used in these applications.

The electrical uses of synthetic rubber deserve special mention. As already noted, Vistanex, Buna S, and the numbered Bunas are the only varieties which show superiorities to natural rubber in respect to purely electrical properties. They are being used as insulation for wires and cables. For many uses, especially at low voltages, the other varieties, such as neoprene, "Thiokol," and Koroseal, may be used also for insulation. There is much wider application, however, of these other varieties as jackets over insulation of natural rubber. They are frequently used in this way to protect natural rubber from the effects of light, air, ozone, oils, and other deteriorating influences. In many types of cables, jackets of synthetic rubber are displacing the lead sheaths formerly used.

The properties of low permeability to gases and stability in direct sunlight have been responsible for the use of synthetic rubber in balloons, from small ones intended for meteorological observations to large passenger-carrying dirigibles. For example, the Goodyear airship *Resolute*, used for sightseeing flights, is covered with fabric coated with neoprene.

The impregnation of silk, cotton, and other fabrics with synthetic rubber of better aging qualities than the natural rubber opens up a large field of household and personal

uses. A few examples of products of this type are umbrellas, raincoats, table cloths, shower curtains, and garment bags. Koroseal which can be obtained in an extremely wide variety of colors, is especially applicable in this field.

Production Figures and Prices

The steady increase in production of each type of synthetic rubber has been accompanied in general by a decrease in price. Many types are still produced in such small quantities that an expanded scale of operations may yet bring drastic reductions in price. In Germany and Russia, the only foreign countries where significant amounts of synthetic rubber are being produced, political considerations enter into reports of production figures, and the controlled economy of these countries makes it almost impossible to compare costs with those elsewhere. Even when market prices are known, the foreign exchange situation of these countries renders impossible a really significant calculation for the conversion of currencies.

In Germany a plant at Schkopau with a capacity of 25,000 tons a year began production in April, 1939 (55). Another at Huls, Westphalia, of the same capacity has been under construction and is probably now in operation (3). Recent Russian figures are not available, but estimates as high as 50,000 tons a year or more are not uncommon (115, 124).

Compared with these figures for the countries where synthetic rubber is used in tires, the production figures seem very small for the United States, where such is not the case. The total production of synthetic rubber of all types in the United States in 1939 probably did not exceed 2,500 tons. Frolich (8) has also recently made a similar estimate. Neoprene and "Thiokol" have been produced in far larger quantities than the other types.

The present market price of neoprene is from 65 to 75¢ a pound, depending on the variety; that of "Thiokol" is from 35 to 60¢ a pound; that of Vistanex is from about 60¢ to a dollar a pound. Koroseal is not sold on the open market, but its price is estimated as being of the order of 50 to 60¢ a pound. The cost of the Buna rubbers has been stated to be less than four times the cost of the natural rubber (125). Perbunan has been sold in the United States at about a dollar a pound, a figure in general agreement with this statement. The cost has probably been somewhat reduced by the recent very extensive expansion of production facilities already mentioned.

Addendum

Since the preparation of this paper, announcement has been made of two new types of synthetic rubber. No disclosure has been made concerning the chemical nature of the "butyl rubber" to be made from petroleum by the Standard Oil Co. of New Jersey. Ameripol, produced by The B. F. Goodrich Co., is obtained from butadiene, presumably by co-polymerization in emulsion, but the nature of the added materials has not been publicly stated.

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The bibliography cites with some degree of completeness the scientific literature of the decade 1930-1940, in which almost all the development of modern synthetic rubber has occurred. References to the patent literature are included only rarely. Brief summaries of almost 250 United States patents dealing with synthetic rubber have been given in a series of articles by Rossman (26). Patents regarding synthetic rubber have also been discussed in some detail by Génin (10), Voge (32a), Whitby and Katz (33), and Midgley (18). The Russian literature, which includes at least one journal devoted exclusively to synthetic rubber, has not been exhaustively investigated, because the journals are not readily accessible, and most of the work has not had a great deal of influence outside of Russia. Sixteen references which have been found to be especially valuable or important are marked with an asterisk. Of the two books devoted exclusively to synthetic rubber the one by Schotz (28), published just befor the beginning of the modern development of synthetic rubber, is chiefly of historical interest. The book by Naunton (19) includes much more recent information and is particularly complete in its discusion of neoprene.

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(Continued on page 51)

"Butyl" Rubber—A New Standard Oil Synthetic

A NEW synthetic rubber-like material, which has been called "butyl" rubber, was announced on June 4 by W. S. Farish, president, Standard Oil Co. of New Jersey, in a statement made before the stockholders of that firm. In contrast to Buna rubber, which originated in Germany and which Standard will also manufacture, "butyl" rubber was discovered in Standard's own research laboratories.

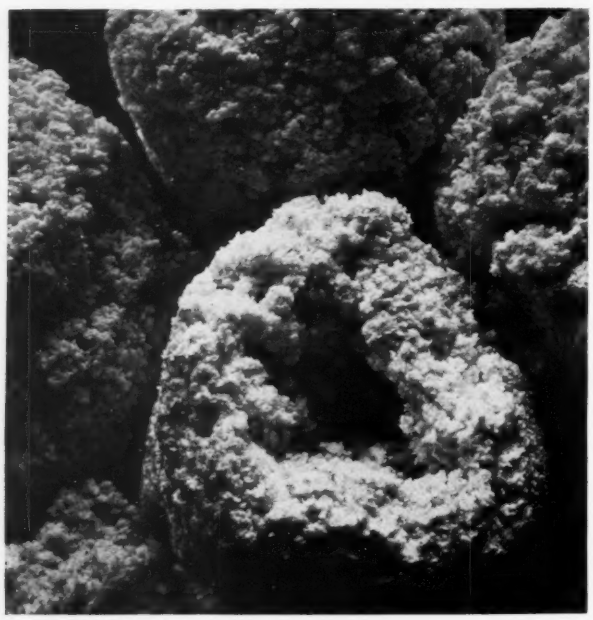
Nature of "Butyl" Rubber

The chemical constitution of "butyl" rubber has not been disclosed. It is not, however, a variant of the numbered or lettered Bunas, or is it a variant of the polybutenes. Unlike Perbunan, "butyl" rubber is not resistant to oils and greases, but behaves similar to natural rubber in this respect. Like natural rubber, the new product is vulcanizable with sulphur, and it is believed that it can be used to replace natural rubber completely in all applications. In many of its chemical and physical properties it is said to be superior to natural rubber.

"Butyl" rubber, which behaves much as does natural rubber, can be compounded, reenforced, and processed in a like manner, using existing rubber manufacturing equipment. It lends itself to extruding as well as milling and molding.

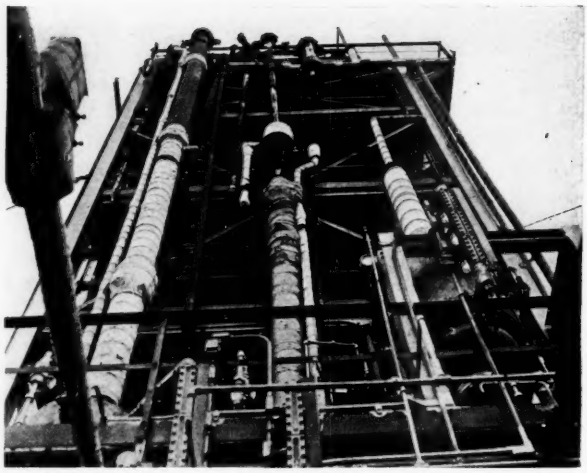
Production

"Butyl" rubber is a polymer made entirely from petroleum and, in this respect, is more nearly a straight petroleum product than is Buna. According to Mr. Farish's statement, it is made by processes more direct and simple than those required for Buna, although its manufacture involves the most advanced technology.



Wide World Photos, Inc.

Unsheeted "Butyl" Rubber Ready for Compounding and Processing



Wide World Photos, Inc.

Exterior View of Pilot Plant for Production of "Butyl" Rubber

Primary production problems have been solved, and a semi-commercial pilot plant is in operation at the firm's research center in Bayway, N. J. It is understood that this pilot plant production is relatively large for a plant of this type and much larger than the firm's Buna pilot plant production. The output of the pilot plant at the present time is being used to accumulate a supply of "butyl" rubber which will be turned over to the rubber industry for experimental purposes, probably some time in September. At the same time technical information regarding "butyl" rubber will be divulged to the rubber industry. No plans for licensing production of this rubber, as in the case of Buna, are anticipated. It is believed that Standard will be the sole manufacturer, as the processes involved are much the same as those of oil refining.

The commercial development of "butyl" rubber will be in stages; the first stage is the manufacture of relatively small quantities for the specialty market and for commercial testing in tire production.

However Mr. Farish stated, "Should it become necessary for the United States to produce synthetic rubber in substitution for a major proportion of imported natural rubber, we are in a position to manufacture the 'butyl' rubber from petroleum in any required quantities as rapidly as the necessary plant facilities can be installed."

No announcement has yet been made as to the date when a commercial "butyl" rubber plant will be constructed, but it is presumed that a statement of this nature will be forthcoming.

Use in Tires

In his statement Mr. Farish said, "Both the Buna and 'butyl' synthetic rubbers are superior to natural rubber in respects which are undoubtedly of importance in tire manufacture."

This together with the fact that the company is going ahead with commercial testing in tires indicates that laboratory investigations have shown promise in this direction. Owing to the claims that the process is simpler and more direct it may be further presumed that the cost will be lower than in the case of Buna.

German Patents Relating to Synthetic Rubber-like Materials—III

Law Voge[1]

THE processes of synthetic rubber preparation invented during the period 1909 to 1914, as covered by German patents, have been discussed in Parts I and II.[2] Next will be treated as a unit in consecutive articles the German inventions of 1915 through 1929; these dates again refer to the time of application.

Important developments during this period were the emulsion type of polymerization of the diolefine hydrocarbons and the interpolymerization of butadiene with other materials. The inventions of this period also aimed to cover the following improvements: (1) reducing the time requisite for polymerization; (2) increasing the yield of the product; (3) reducing its stickiness, including surface hardening; (4) eliminating impurities; (5) improving the physical properties, especially strength and elasticity; (6) controlling the chemical reactions for uniformity, especially those with an alkali metal; and (7) improving the use of fillers in vulcanized products.

Curiously enough, there are certain years in this period of 1915 through 1929 when no applications were made in Germany for patents relating to synthetic rubber. Thus, in the years 1915, 1919, 1920, and 1922 through 1924, and 1926, no applications were filed.[3]

On October 13, 1916, the Badische Anilin & Soda-Fabrik, Ludwigshafen, applied for patent[4] on a "Process for Transforming the Rubber-like Compounds Obtained by the Process of Patent 287,787 and its Supplements"[5] into a well-vulcanizable form. The claim of this patent reads: "Subjecting the products of the previous patents to gentle oxidation." *Example:* The product of Patent 287,787, after washing with water, is spread out loosely and exposed to air. With gradual drying, after three days the product has absorbed 3% of oxygen. It is still slightly sticky, but can be well worked to sheets on the rolls.

The Accumulatoren Fabrik, A.G., Berlin, on January 3, 1917, applied for a patent[6] on a "Process for Pretreating the Commercial Synthetic Rubbers Which, Because of Their Low-Stickiness and Elasticity, Can Be Worked Only with Difficulty on the Rolls." In this invention the claim covers the heating of the synthetic rubber to a temperature of over 100° C. and then subjecting it to washing and kneading. *Example:* Synthetic rubber is placed in a vulcanizing vessel and exposed to steam at 120° C. for three hours and rolled out to a thin film. After ordinary drying the product is applicable to mixtures which are to possess somewhat less workability.

The first patent[7] of Plauson's Forschungs-institut G.m.b.H., Hamburg, was applied for on May 13, 1917, by Herman Plauson, on a "Process for the Preparation of Rubber-like Products." This covers a distinctly different operation; the well-known catalytic action of Friedel and Crafts with anhydrous aluminum chloride is used. The claim reads: "Diolefines in mixtures with drying oils and with the addition of zinc chloride or aluminum chloride are polymerized at ordinary or higher temperature and then, optionally, the rubber removed from the reaction mass by extraction in solvents." *Example:* Complete solution of China wood oil, 100 parts, and 2,3-dimethylbutadiene, 100 parts is first obtained and then are added: aluminum chloride (anhydrous), 10 parts, and zinc chloride (anhydrous), 20 parts. The mixture is stirred or shaken well. After 10 to 30 minutes the mass expands greatly and must be cooled to prevent burning. It is then treated with a solvent, for instance, benzene, and only the rubber is dissolved. The rubber can then be precipitated from the solution by alcohol.

The Accumulatoren Fabrik, A.G., applied for a second patent[8] on December 6, 1917, on a "Process for the Preparation of Solutions of Great Adhesive Strength from Those Commercial Synthetic Rubbers Which Are Insoluble or Difficultly Soluble in Ordinary Solvents, or the Solutions of Which Do Not Have Sufficient Adhesive Strength." The claim reads: "The synthetic rubber is heated in air to a temperature at least equal to its melting point at a pressure of one atmosphere and is then dissolved in the ordinary reagents." Unfortunately no example is presented in the patent.

The invention of a "Process for the Preparation of a Highly Elastic Vulcanizate of Synthetic Rubber" was claimed in a patent[9] applied for on January 23, 1918, by the Mitteldeutsche Gummiwaren Fabrik, A.G., Frankfurt. The claim specifies the use of coal tar oil as an elastic component before the vulcanization. As an example, there are mixed in the well-known manner on rubber mixing rolls the following ingredients in the proportions indicated: synthetic rubber, 100 parts, coal tar oil, 100 parts, sulphur, 10 parts, and zinc oxide, 25 parts. Vulcanization is performed at 140° C. for 10 minutes. The product is stated to have excellent elasticity.

A patent,[10] the purpose of which was to prevent the oxidation of synthetic rubbers, was applied for by Badische Anilin on February 27, 1918. The claim reads: "The products treated with phenols or naphtholenes." The patentee presents as an example, taking the product from 2,3-dimethylbutadiene-1,3 of Example No. 1 of Patent 287,787.[5] A black, worm-like, extremely voluminous material is freed from the alkali by washing with water. Most of the water is then removed in the wringer rolls, and the wrung product is then mixed intimately with 1% by weight of beta-naphthol on the mixing rolls. The rubber so pretreated is then dried in an airy drying chamber on frames at about 45° C. and is then ready for use. Rubber not impregnated with naphthol and dried under these conditions soon oxidizes to a resinous lump; while the naphthol treated material remains pliable.

On March 28, 1918, the Badische company followed this invention up with a supplementary patent,[11] having the same purpose in mind: namely, preventing the oxidation of the finished product. In this patent the claim covers the use of aromatic nitro compounds substituted

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[1] Research chemist and engineer, Washington, D. C.
[2] INDIA RUBBER WORLD, Apr., 1, 1940, pp. 48-50; May 1, 1940, pp. 47-49.
[3] The initial war drive and later economic depression were doubtless the chief causes of this intermission in activity.
[4] No. 307,341, granted Aug. 13, 1938.
[5] INDIA RUBBER WORLD, May 1, 1940, pp. 47, 48, 49.
[6] No. 329,171, Nov. 13, 1920.
[7] No. 361,429, Oct. 14, 1922.
[8] No. 331,031, Dec. 22, 1920.
[9] No. 315,321, Oct. 24, 1919.
[10] No. 330,741, Dec. 16, 1920.
[11] No. 332,305, Jan. 26, 1921.

for the phenols and naphthols of the preceding patent. In the example the same product, that is, from Example No. 1 of 287,787,[5] is freed from alkali with water, wrung out on the wringer, and then mixed with 1% of its weight of nitronaphthalene and dried at not over 45° C. on frames in an airy drying chamber.

The use of these products, described in the last two patents, was proposed in a patent application[12] of May 4, 1918, by Badische for assisting in the polymerization of butadiene. The claim reads: "Polymerizing butadiene and its homologs in the presence of alkali-metal-freed products of the Patent 287,787 and its supplements 294,816, 294,817, 294,818, 296,787."[5]

Example: Pure isoprene, 200 parts by weight, and sodium-carbon dioxide rubber (from butadiene), five parts by weight. This latter component is prepared according to the process of Patent 287,787 and freed from alkali-metal and dried according to the immediately preceding processes. This mixture is placed in a sealed vessel in an inert atmosphere for four to five weeks at 40° C. When opened, the whole vessel will be found filled with a snow-white spongy mass. If carried out at a lower temperature, the reaction requires still more time.

On August 22, 1918, Badische applied for a supplementary patent[13] to the last, the claim of which covers a special form of execution of the process of Patent 329,676 characterized in that the polymerization is carried out in the presence of aromatic-hydroxyl- or nitro-compounds or other compounds, preventing the oxidation of the synthetic rubber products.

Example: 2, 3-dimethylbutadiene-1, 3, 200 parts, sodium-carbon dioxide rubber, two parts, dipiperidyl, two parts. The sodium-carbon dioxide rubber is prepared by freeing from alkali the product of Patent 287,787. This mixture is heated in a closed vessel in an inert atmosphere at 65° C. for about three weeks. The product, a white, spongy mass, fills the vessel. Instead of dipiperidyl, beta-naphthol or nitronaphthalene can be used.

A. Jonas and Rh. E. Tschunkur, on August 22, 1918, assigned to Fabenfabr. vorm. Fr. Bayer & Co. an application for a patent[14] on a "Process to Prevent Rubbers or Synthetic Rubbers from Becoming Sticky or Resinous." The claim of this patent states: "Substances treated with such aromatic or heterocyclic compounds or their derivatives or substitution products containing two or more amino groups, or at least one amino group, together with hydroxyl groups or similarly substituted groups." A further claim specifies, optionally, treatment with substances of the same classes, but containing oxy groups. *Example:* The product of the Kondakow[15] polymerization process is rolled intimately with 1% of 1, 8-naphthalene diamine and exposed to light, air, and heat. The durability of the product is said to be greatly increased.

"A Process for the Preparation of Guttapercha-like Substances" formed the subject of patent application[16] on October 4, 1918, by Felten & Guilleaume Carlswerk, A.G., Cologne, the claim of which states: "Mixing ordinary or deresinized rubber, with or without polymerization agents, with polymerizable substances in such proportions that after the polymerization the mass softens or melts at temperatures well below 100° C." *Example:* Isoprene, one kilogram, cumarone, one kilogram, concentrated sulphuric acid, 0.25-0.4% by volume of the cumarone, are heated together in an autoclave (the temperature is not given). The reaction product is washed in alkaline water, then in pure water, and dried. *Another example:* Dimethyl-butadiene, one kilogram, phenol-formaldehyde intermediate continuation product, liquid or solid, five grams, are mixed and heated in an autoclave at 120° C. *Third example:* Dimethylbutadiene, one kilogram, is mixed with methyl acrylate, 600 grams, and polymerized in the customary manner.

On November 1, 1918, patent[17] was applied for by Traun's Forschungslaboratorium, G.m.b.H., Hamburg (70). This firm had been interested in the development of rubber since 1856. The patent is entitled "A Process for the Preparation of Rubber-like Materials." The claim covers subjecting butadiene or its homologs or their mixtures, or their semi-polymerized products, alone or in combination with inert organic solvents, to a pressure of 50 to 600 atmospheres for a shorter or longer time and optionally in the presence of porous materials or in emulsification with water, but at not over 30° C., and optionally in the presence of polymerization accelerators. *Example:* 100 parts of liquid butadiene are compressed by a nitrogen atmosphere in a high-pressure equipment to 300 atmospheres. Then, by valve, the vessel is hermetically sealed and allowed to stand for four weeks at room temperature. The product is almost transparent and homogeneous and can be readily rolled to sheet form. At 600 atmospheres the polymerization is complete in five to six days.

A patent[18] was applied for on this same date, November 1, 1918, by Plauson's on a "Process for the Preparation of Vulcanizable Materials Closely Related to Rubber." Here the claim specifies that butadiene, its homologs, analogs, or their mixtures, or semi-polymerizates, be mixed with acrolein alkyl (or aryl) amines, optionally in the presence of inert solvents or porous material and be polymerized or subjected to the action of ultra-violet rays or silent electrical discharge. *Example:* Butadiene (liquefied), 100 parts by weight, and acrolein methylamine, four to six parts, are subjected to 300 atmospheres pressure at room temperature for one week to two weeks in a bomb. The process can be accelerated by adding 1% to 3% of alkali or of ammonia. The product rolls well and can be vulcanized like natural rubber.

Here we encounter, chronologically, one of the surprisingly barren periods in the development of the synthetic rubber industry, for apparently between November, 1918, and April, 1921, no application for patent on such products was made in Germany.

The Siemens & Halske Co. entered the field of synthetic rubber preparation with application for patent [19] on April 5, 1921, covering a "Process for Hydrating Artificial and Natural Rubber." The claim of this patent specifies: "The solutions of the rubber in ether, ligroin, cyclohexane, or their homologs, are treated with hydrogen in the presence of platinum black or palladium black optionally at increased pressure." In the example presented, dimethylbutadiene rubber (freshly prepared from beta-gamma-dimethylbutadiene by heating in a tube at 80° C. for six weeks) is freed as completely as possible from unchanged raw material, etc., and then immediately dissolved in absolute ether and shaken with the platinum black and pure hydrogen at ordinary temperature. Reduced pressure occurs through the rapid adsorption of hydrogen. The platinum is removed by filtration, and the solvent evaporated. The product has lost the life ("nerve") of rubber, but still has certain plastic properties.

Once again, between April, 1921, and November, 1925, apparently no patent was applied for in Germany on synthetic rubber.

(To be continued)

[12] No. 329,676, Nov. 23, 1920.
[13] No. 333,496, Feb. 28, 1921.
[14] No. 366,114, Dec. 29, 1922.
[15] India Rubber World, Apr. 1, 1940, p. 48.
[16] No. 375,639, May 16, 1923.
[17] No. 329 593, Nov. 23, 1920.
[18] No. 371,710, Mar. 17, 1923.
[19] No. 389,656, Feb. 5, 1924.

Ameripol—A New Butadiene Synthetic Rubber

TWO announcements, the development of a new synthetic rubber and the manufacture of tires from this rubber, were made on June 5 by John L. Collyer, president of The B. F. Goodrich Co., Akron, O., before a group of 500 industrialists, military experts, scientists, and the press at the Waldorf Astoria, New York, N. Y. The new synthetic, described as "Liberty Rubber," has been named Ameripol, which signifies a polymer of American materials. Like other synthetic rubbers, at present it costs much more than natural rubber, but with increasing production, economies may be expected which will reduce the price. The story of how Goodrich developed Ameripol after 14 years of research in this field was told by Dr. Waldo L. Semon, discoverer of Koroseal, who, with his assistants, is credited with the new development.

Dr. Semon (Center) Demonstrating the Coagulation of Ameripol Latex to David M. Goodrich, Chairman (Left), and John L. Collyer, President, of Goodrich

Ameripol Process

The basic material used in the manufacture of Ameripol is butadiene, which must be of high purity for this purpose. This is mixed with other ingredients, the name and the nature of which are as yet undisclosed, but which are said to be prepared from natural gas and air. The mixture is then emulsified with soap and polymerized while being agitated under the influence of heat. The synthetic rubber latex thus formed is coagulated with acid, and the coagulum is sheeted and dried in much the same way as is natural rubber latex.

Ameripol is a butadiene copolymer with the nature of the secondary materials undisclosed. In this respect, then, the new product may be considered similar to the German synthetic rubbers, Buna N, a copolymer of butadiene and acrylonitrile, and Buna S, a copolymer of butadiene and styrene. The Buna rubbers are also polymerized in the emulsion state. Ameripol, however, is said to be an exclusive Goodrich product and not to infringe any existing patents.

The First Ameripol Tire Being Displayed by Dr. W. L. Semon

General Characteristics

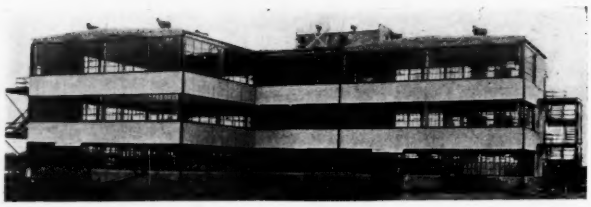
Few details are available regarding the characteristics of the new synthetic, and its evaluation based on a comparison of its properties with those of natural rubber and other synthetic rubbers must await future disclosures of laboratory tests. Ameripol is claimed to be equal or superior to natural rubber in many of its important properties and, when vulcanized, is said to resist swelling in gasoline, mineral, or vegetable oils. Indications are that Ameripol can be used for most of the rubber products on the market today.

In general Ameripol can be handled like natural rubber in compounding, mixing, extruding, calendering, and vulcanizing; all operations are practical on standard rubber working machinery. Smaller batches and higher processing temperatures are used, but no processing difficulties of any magnitude are encountered. Ameripol has some natural tack and can be used for frictioning and combining fabrics without special treatment. At present it is used for frictioning tire cord. In the same sense as for natural rubber, sulphur is necessary for vulcanization.

Carbon black reenforces Ameripol much in the same way as it does natural rubber, but higher percentages can be used in the case of the synthetic. In tire stocks 60 to

Washing Ameripol in the Goodrich Akron Plant

70% of carbon black on Ameripol is used; while for some applications as high as 200% can be incorporated in the mix. With carbon black at its comparatively low price per pound, the higher loading is effective in bringing the formulated cost toward that of natural rubber stocks. Other compounding ingredients are used in much the same way as with natural rubber. The conditions for zinc oxide, antioxidants, and inert fillers are the same as with natural rubber. With respect to accelerators, a larger quantity is needed in general. Especially selected softeners are desirable, but usually more softener can be used than with natural rubber. The highest quality stocks are black, although colored stocks can be made.



New Goodrich Ameripol Plant to Be Ready for Production in the Fall

Production Facilities

Butadiene for use in the manufacture of Ameripol is purchased by Goodrich from outside sources. If necessary, the butadiene is purified before use.

After preliminary laboratory investigation Goodrich built a pilot plant which has been in operation 18 months; while a recently completed semi-commercial plant is now producing Ameripol in quantities ample to meet the firm's projected production schedules. At present a manufacturing plant expected to be ready this fall is under construction. This unit will have a daily capacity of five to ten tons of Ameripol, and additional units can be built to produce any required amount of the synthetic.

Production of Ameripol will be utilized entirely by Goodrich as long as the firm's requirements are unfilled. When the time is reached when production exceeds Goodrich needs, a decision will be made as to the policy to be followed in connection with distribution of the excess.

Economic and Political Significance

In introducing Ameripol, Mr. Collyer emphasized the importance of maintaining rubber supplies as a foremost consideration in our program for national security.

Quoting Mr. Collyer in part, "The high roads of trade are being bombed from the face of the earth, and we can no longer — without question—rely upon distant sources of vital supplies . . . there is one huge question mark on the blueprints being drawn today in Washington—That question mark is—rubber . . . in the hundreds of meetings being held all over this country today, men are asking the question: Can we hope to maintain our rubber imports. Ladies and gentlemen, this is no time for mere HOPE. But what can we DO?"

An answer in part to this question was the announcement of Ameripol.

But Mr. Collyer warned, "At what precise date Goodrich, or any other organization, can go before the American public with the announcement that America need no longer depend upon natural rubber, we cannot foretell; but this we do know, substantial progress has already been made—and this progress must be speeded up, *right now!*"

Tire Production

The announcement that Goodrich had begun the manufacture of tires using Ameripol to replace natural rubber in proportions varying from 50 to 100% was made after pointing out that tires account for over 70% of our country's rubber consumption. The step was taken, according to Mr. Collyer, in the interest of national preparedness and to demonstrate that tires can be made entirely from American materials.

Ameripol tires will soon be on sale through the regular Goodrich channels of distribution. However orders are now being accepted for only the 6:00 x 16 size of tire at a price stated to be about one-third higher than for the standard 6:00 x 16 tire. These orders will be filled in order of their receipt. Mr. Collyer emphasized that in purchasing such tires motorists are buying increased assurance that they can continue to have tires for their cars in any eventuality. At the present time Goodrich is in a position to produce 500 to 1,000 Ameripol tires weekly. However part of the present Ameripol production is available for applications other than tires.

Airplane Armor Plate Made of Rubber and Steel

DEVELOPMENT of an airplane armor plate of rubber and steel, which in tests was said to be equal in bullet-penetration resistance to a test standard armor plate weighing 20% more, was announced on June 18 by F. B. Davis, Jr., president of United States Rubber Co. Development of the new plate, which uses a secret rubber compound, has been carried on for nearly three years at the firm's Detroit plant. The weight-saving feature of the rubber-steel armor, according to Mr. Davis, could be utilized by plane manufacturers for greater armament, wider armored areas, greater maneuverability, or greater cruising radius. The firm was said to be ready to produce this new armor in quantity, dependent upon the supply of steel plate. The announcement also pointed out the implication of a potential saving in steel plate needed for plane armoring, a saving which could be diverted to other needs.

Production and Sales of Rubber Chemicals for 1939

ACCORDING to a preliminary report by the United States Tariff Commission on the production and sales of synthetic organic chemicals in the United States, synthetic coal-tar chemicals for use in compounding rubber increased 60% in production in 1939. Those used as accelerators were up 47%, and those used as antioxidants, 69%.

Non-coal-tar rubber chemicals also increased considerably in production, but not so much as did those of coal-tar origin. The figures for 1939 are shown in the table below.

	Production	Sales		
	Pounds	Pounds	Value	Unit Value
Coal-tar, total	29,966,425	20,964,697	$10,081,102	$0.48
Accelerators	12,090,444	7,772,922	3,543,376	0.46
Antioxidants	17,875,981	13,191,775	6,537,726	0.50
Non-coal-tar, total	13,122,206	11,896,450	3,086,119	0.26

A Suggested System for Classification of Polymers

H. Mark[1]

WITH the rapid increase in the number of high polymeric compounds that are finding use in industry today, it would be desirable to have a systematic classification of these materials that would be descriptive of their structure and more important properties. In the endeavor to achieve such a classification we are aided by the fact that our knowledge of the structure of these materials has been considerably improved during the past few years. Today we can depict the general structure of high polymers with a fair degree of accuracy.

Application of Metallography Concepts

In developing a system for the classification of polymerization products, the concepts applied in metallography will be combined with the laws of organic chemistry. The basic units of synthetic high polymers are simple molecules which react according to the laws of organic chemistry. On the other hand the final products of a polymerization process are usually complex solids which are defined by their tensile strength, elasticity, refractive index, density, etc., as in the classification of metals and their alloys. While the laws of stoichiometry hold strictly for the structural composition of a one-component organic polymer, they lose their significance in the case of a co-polymer. Thus, in the latter instance, the stoichiometric laws must be replaced by others that are more suitable. For this purpose the familiar laws applied to binary and ternary systems in metallography have been chosen.

In the system of classification presented in this paper, highly polymerized materials will be covered with particular emphasis placed upon materials exhibiting rubber-like properties. Poly condensation products such as bakelite, nylon, "Thiokol," urea formaldehyde resins, or glyptals require a somewhat different system of classification. As these materials are not closely related to the problem of synthetic rubber, except in the case of "Thiokol," a system covering them may be more appropriately treated elsewhere.

Unitary, Binary, and Ternary Systems

The development in this field began with attempts to polymerize pure unsaturated organic compounds. During the World War, for instance, a considerable amount of dimethylbutadiene was polymerized in Germany and used as a substitute for natural rubber. Later polymers of vinyl acetate, styrene, and acrylic esters were produced in America and Europe under various trade names: Gelva, Mowillith, Perspex, Trolitul, Victron, etc. They were water-clear, soluble, resin-like materials which found application chiefly in lacquers and varnishes. All of these materials were unitary systems, i.e., high polymers containing a single chemical component. Thus, in our scheme they correspond to the pure metals in metallography.

[1] Adjunct professor of organic chemistry, Polytechnic Institute of Brooklyn, Brooklyn, N. Y.

Still later polymers of butadiene, chloroprene, and isobutene were introduced under the names: Buna 85, Buna 115, Neoprene E, Neoprene G, and Oppanol B. These materials are also unitary systems.

While this development was going on, the principle of co-polymerization was discovered. Two unsaturated organic compounds were found to be capable of interpolymerizing and combining to form long-chain molecules. With two components present co-polymerization thus produces a binary system and is analogous to the formation of an alloy of two metals.

Among the binary systems which have been produced are the following: "Vinylite" Series V resins, co-polymers of vinyl acetate and vinyl chloride used as molding and injecting materials and for the production of Vinyon yarn; Igelits, co-polymers of vinyl chloride and vinyl acetate or acrylic ester, used for chemically resistant tubing, tank linings, etc., as molding and injecting materials, and for the production of PC-fiber; Buna S, a co-polymer of butadiene and styrene with rubber-like properties; and Perbunan, a co-polymer of butadiene and acrylontrile, also rubber-like.

Although these binary systems exhibit properties hitherto not found in single-component systems which make them more suitable for certain applications, it is believed that polymerization products developed on the basis of a ternary or three-component system will be more nearly perfect in regard to the desired characteristics. This conclusion is based not so much on the analogous development in metallography, but more upon our general knowledge of how the qualities of a high polymer depend upon the properties and amount of the various components present.

For the above reason the present scheme of classification is based upon the ternary system; it also permits, of course, the classification of binary and unitary systems.

Basic Triangle

The following three types of simple unsaturated organic compounds are the essential components of a high polymer of the ternary type.

A. One bifunctional component which contains two unsaturated bonds or groups such as butadiene, isoprene, chloroprene, dimethylbutadiene, divinyl ether, and vinyl acetylene. This component introduces into the system the possibility of obtaining cross-linkages, of being vulcanizable, and of having sufficient double bonds remaining to react with fillers and activators. Synthetic rubbers will always contain a certain amount of a bifunctional component.

B. One monofunctional softening component such as propene, butene, isobutene, acrylic methyl ester, and vinyl acetate. Such molecules introduce into the co-polymer high elasticity, flexibility, and plasticity. Their presence during the polymerization also appears to direct this process and to make it easier to control.

C. One monofunctional hardening component such as styrene, acrylonitrile, vinyl chloride and the methacrylic esters. Such molecules impart toughness and hardness and also appear to facilitate the process of polymerization.

To represent the foregoing graphically a triangle has been drawn, each point of which represents one of the three above-mentioned groups. This triangle is shown in Figure 1. The point *A* represents one of the substances belonging to group A, for instance, butadiene or chloroprene. The point *B* equally stands for the monomeric materials of

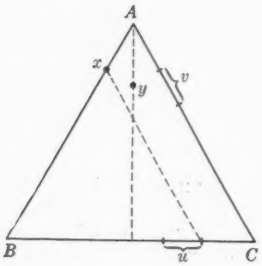


Fig. 1. Basic Triangle

A. Bifunctional component
B. Softening component
C. Hardening component
u. Range of molecular composition for Vinylites and Igelits if B is vinyl acetate or acrylic ester and C is vinyl chloride
v. Range of molecular composition for Buna S if A is butadiene and C is styrene
x. Mixture of three mols of butadiene (A) and one mol of isobutene (B)
y. Mixture of three mols of butadiene (A) and one mol of isobutene (B) and one mol of styrene (C)

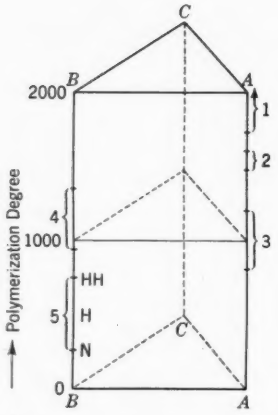


Fig. 2. Triangular Prism

Basic triangle indicates the composition; third dimension gives average polymerization degree; ranges are defined in Fig. 3

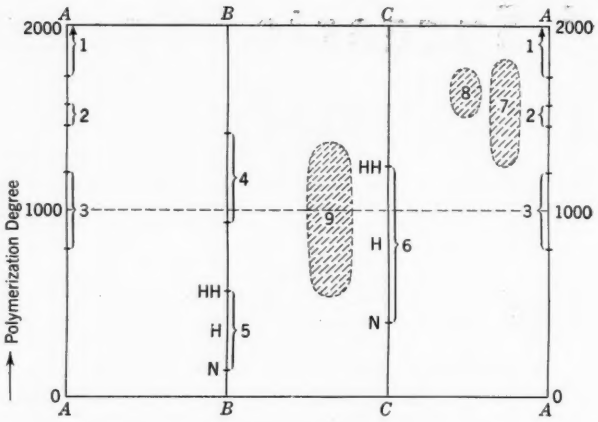


Fig. 3. Unfolded Prism of Fig. 2; Abscissa Denotes Composition; Ordinate Indicates Polymerization Degree up to 2,000

AA 1	Chloroprene: range of Neoprene Types D, E, and G; highest polymerization degree presumably greater than 2,000 Butadiene: range of Buna 115
AA 2	Butadiene: range of Buna 85, SKA and SKB rubber
AA 3	Dimethylbutadiene: range of Methyl rubbers B, H, W
BB 4	Isobutene: range of Vistanex and Oppanol types
BB 5	Vinyl acetate: range of Gelva 6, 15, 30 and of Mowillith N, H, and HH Acrylic methyl ester: range of Plexigum
CC 6	Styrene: range of different polystyrene types such as Trolitul N, H, and HH, Victron, etc. Methacrylic methyl ester: range of Lucite, Crystallite, Perspex Vinyl chloride: range of some types of Koroseal, Vinylite, and Igelit
AA-CC 7	Butadiene and styrene: range of Buna S Butadiene and acrylonitrile: range of Perbunan
AA-CC 8	Butadiene and styrene: range of Buna SS Butadiene and acrylonitrile: range of Perbunan Extra
BB-CC 9	Vinyl chloride and vinyl acetate: range of some types of Vinylites (Vinyon) and Igelits Vinyl chloride and acrylic methyl ester: range of some types of Igelits (Mipolam)

the second group such as isobutene or vinyl acetate; while point *C* represents in the same way the hardening component. All possible binary systems will be located somewhere on the three edges of this basic triangle and, following the procedure used in metallography, the ratio of the amount of A to B present in the mixture can be indicated by a point on the edge *AB*. If we have, for instance, a co-polymer of butadiene and isobutene containing one mol of isobutene to three mols of butadiene, the corresponding point on the edge *AB* would be one-fourth of the distance *AB* from *A* (point *x*); the range of Buna S is covered by *v*; the range of some of the Igelits by *u*.

It is also evident that all possible ternary systems can be represented by all the possible points inside of the triangle of Figure 1. It would be reasonable to assume that a co-polymer of three mols of butadiene, one mol of isobutene, and one mol of styrene, as an example, would have quite interesting properties from the point of view of synthetic rubber. Such a mixed polymer would be represented in our scheme by the point *y* located inside of the triangle.

Spatial Representation

Any quantitative property which is characteristic of a polymer of the corresponding point in the base can now be plotted in the space above the basic triangle. For the purpose of this article the average polymerization degree of the material has been chosen. It must, of course, be kept in mind that this average degree of polymerization is not alone representative of the important commercial properties of the material. These properties depend to a considerable degree upon whether the substance is built up chiefly of long-chain molecules or whether the chains are cross-linked to a certain extent, but at least a preliminary step in the evaluation of these compounds will be made if we plot the average degree of polymerization along a third axis perpendicular to the triangle *ABC*. The degree of polymerization is closely associated with the molecular weight of the material and can be determined experimentally, with a certain degree of accuracy, by viscosimetry, osmotic measurements, or by use of the ultracentrifuge. The numerical values for degree of polymerization which are used in this paper have been taken from various articles that have appeared in scientific literature, in which the above-mentioned methods have been applied in the determinations.[2]

The values referred to have been plotted in Figure 2. In the triangular prism formed the base represents the initial mixtures before polymerization. Along the three lines *AA*, *BB*, and *CC* are plotted the degree of polymerizations of the pure one-component polymers. The height above the base indicates the polymerization degree of a particular material. If we consider, for instance, butadiene as the initial substance, we obtain Buna 85 in range 2; Buna 115 in range 1. If we consider chloroprene as a basic material, we obtain the different neoprene types in range 1 and above. Similarly with isobutene we find the Oppanol and Vistanex types along the line *BB* in range 4. With vinyl acetate as a starting material we find the large group of the Gelva and Mowillith resins in range 5. Finally we have the mono-component resins prepared from styrene, vinyl chloride, and methylmethacrylate along the line *CC*. The three planes, *AA-BB*, *AA-CC*, and *BB-CC*, contain the binary co-polymers: Buna S, Perbunan, Vinylite, and Igelit. To obtain a better insight as to the relative position of all these products, we may imagine that the prism of Figure 2 be cut along the line *AA* and unfolded in the plane of the page.

The result of this procedure is shown in Figure 3. There all the resins mentioned above are classified according to their composition and to their average degree of polymerization. All products which are obtained by

[2] See for example: "Die Hochmolekularen Organischen Verbindungen," H. Staudinger, Berlin, 1932; chapter by E. O. Kraemer and R. Signer in "The Ultra Centrifuge," Th. Svedberg and K. O. Pederson, Oxford, 1939; "Collected Papers," W. H. Carothers, New York, 1940; and "Hochpolymere Chemie," K. H. Meyer and H. Mark, Leipzig, 1940.

polymerization of the three components of the type A, B, and C can be worked into this scheme. In Figure 3 the ordinate represents the approximate average degree of polymerization and runs up to a value of 2,000. This is presumably the upper limit of what is now actually reached by the different commercial products. It can be seen that all substances exhibiting typical rubber properties are between 1,000 and 2,000 either along the line *AA* or along the line *BB* or in the neighborhood of *AA* in the *AA-CC* plane.

On the other hand all materials used either in lacquers or for molding and injecting purposes are located at about 1,000 or below along *BB*, *CC*, or in the plane between these lines. Although no polymers of a degree above 1,000 and in the *AA-BB* plane seem to be on the market yet, there is no doubt that they would exhibit very interesting rubber-like properties presumably with very highly reversible elasticity.

The scheme represented in Figure 2, of course, would also permit the classification of ternary systems. The representative point of a ternary compound would be located within the prism; the height would indicate the approximate degree of polymerization, and the position of the projection to the base triangle would be characteristic of the composition in respect to the three components A, B, and C.

It should be realized, of course, that this method of classifying and describing high polymers is only a first approximation and does not include all of the properties which should be considered in order to estimate the value of the described materials. However this is also true in the case of the formulas of organic chemistry and the graphic representation of a metallic alloy where only a certain amount of information is obtained in reading the chemical formula or the phase diagram. But in all three cases the adopted way of representation sheds some light on the structure of the material and its relation to other similar substances.

Synthetic Rubbers

(*Continued from page* 43)

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The Present Status of Neoprene

A NUMBER of interesting points, summarized below were brought out in a statement on neoprene made by E. R. Bridgwater, of E. I. du Pont de Nemours & Co., Inc., before the Military Affairs Committee of the U. S. Senate on June 14.

The first commercial neoprene plant was built in 1931, with production starting in 1932. Sales each year, except in 1938, more than doubled those of the preceding year. Shipments now total 550,000 pounds monthly and go to about 250 American rubber manufacturers. Neoprene is used commercially in solid industrial tires and experimentally in pneumatic tires. It is preferable to natural rubber for a tire's outer surface because of sunlight resistance, and neoprene tire treads equal in abrasion resistance to the best made from natural rubber can be produced. But neoprene has no properties that would tend to make it superior to natural rubber for ply stocks.

The immediate construction of huge synthetic rubber plants, particularly if it is possible to build up reserves of natural rubber, seems unwise because of the division of metal structural materials and skilled labor from other defense activities and because of the rapid plant obsolescence now being experienced in the still early stages of commercial production. It is feared that huge plants now would cause a cessation of new construction for many years, retarding product improvement, process simplification, and reduction in production costs.

Substantial sums for neoprene production have been expended in the last five years. This year more than $2,000,000 is being spent, and within a few months a capacity of 1,000,000 pounds per month will be reached.

EDITORIALS

Rubber, a Strategic Material

IMPORTANT as it may be in the performance of peacetime activities, rubber is even more essential in the manufacture of modern mechanized implements of war, and, although used in less volume, it approaches the rating of iron ore as a necessity. Because the large North American consumption of rubber must be accommodated through importation from distant sources or the perfection of mass production processes for the synthesis of suitable substitute materials, many suggestions have been advanced as to possible means for alleviating the situation which would result if our present supply of natural rubber were interrupted.

The consuming field for rubber, when considered in the broad sense, may be divided into two distinct phases: first, the uses for which the natural vegetable product is suitable; and second, the applications which result only from the special characteristics found in certain synthetic rubber-like materials, but not obtainable in the natural product. The present commercial synthetics are non-competitive with natural rubber and justify a price differential. Although it is logical to assume that the cost of producing the synthetic materials will be reduced when the volume increases, no facts are in evidence which indicate that a direct competitive volume price will be possible even though synthetic rubbers should completely replace the natural product. Aggravating the economic competition is the fact demonstrated in recent years that if necessary for continuation of the established crude rubber growing industry, the natural product can be marketed at a fraction of its present price.

It is quite evident that future developments and efforts toward enlarged application of synthetics should be directed along two lines: first, a continuation of past trends to extend the utility of types with special characteristics to new fields and through larger consumption reduce the cost; and second, increased activity toward the perfection of substitutes equal in quality to rubber with primary emphasis on a competitive cost. The former objective is constructive in that greater service may be rendered by the rubber industry, and the latter is protective and essential to meet an emergency if our distant supply of crude rubber should be cut off.

When analyzing the possibility of such an emergency and the feasible methods for meeting it, a number of attendant conditions need be considered.

1. The present major source of natural rubber lies within the concentrated area comprised by Malaya and the East Indies. Although rubber is being produced in quantities of minor importance in other areas, no large quantities could be obtained until after the establishment of new plantations with the attendant difficulties and enormous cost. Such a project would be realized too late to alleviate any early restriction and, when completed, would constitute the duplication of a previously established source of supply.

2. Although, through altered territorial jurisdiction or restriction of navigation, the control of natural rubber might become invested in hostile interests, the permanent disastrous effects upon international commerce resulting from a newly developed replacement supply would be such that any country would give serious thought before taking steps that would entirely disrupt the profitable and established industry of rubber growing. Even in war, consideration must be given to the reconstruction period.

3. Annual production of a half-million tons of synthetic rubber would appreciably tap the supply of raw materials, now partially essential for other purposes. Perfection of production methods and processing technique would necessitate a large expenditure of time and money and probably some obsolescence of equipment. When completed, this program also would result in a duplicate supply and an international economic liability.

4. Very recently announcement was made of new types of synthetic rubber which are said more nearly to approach crude rubber in characteristics and economic equality. As with other synthetics in production for several years, the ultimate cost can be determined only after processes and production methods have been perfected. Tires, which consume the major portion of rubber and constitute the most essential item in defensive equipment, appear to be the logical outlet for promoting industrial development. Large commercial consumption of synthetic rubber tires at a higher cost does not appear probable unless fully compensating advantages are assured. As national welfare is the prime objective of such a program, federal orders based on legitimate costs are justifiable as a means of obtaining more information as to the serviceability, production possibilities, and ultimate cost of synthetic rubber as a direct substitute for the natural product.

5. Reclaimed rubber, which can be produced in rapidly increasing amounts, constitutes a tangible means of reducing crude or synthetic rubber requirements.

Effective and practical means of anticipating a possible interruption of the crude rubber supply within a period of even several months are available through cooperative efforts by the industry and the federal government to accumulate maximum stocks of crude rubber, preparatory plans for quick substitution of larger percentages of reclaimed rubber for crude, and aggressive development of synthetic rubber on a basis such as is justified by economics and national utility. With these projects well in hand and with emergency curtailment of civilian consumption of rubber products, the necessities could well be accommodated for such time up to a year as would be required to arrange for full production of a synthetic rubber. An immediate and unified program is very essential.

S. C. Stillwagon

EDITOR

What the Rubber Chemists Are Doing

Rubber Division News

AS ANNOUNCED here last month, the Rubber Division, A. C. S., will hold its fall meeting September 12 and 13 in Detroit, Mich., in connection with "Convention One Hundred of the American Chemical Society," as the Detroit Section has chosen to call the one hundredth meeting of the society. Headquarters of the division will be at the Book-Cadillac Hotel; while technical sessions will be held in the Commandery Asylum of the Masonic Temple.

In addition to the program of general papers, a symposium on "Rubber, Synthetics, and Plastics in the Automotive Industry as Viewed by the Engineer and the Chemist," will be held Thursday, September 12. Arrangements for the symposium and for the division banquet, which is scheduled for Thursday evening in the grand ballroom of the Book-Cadillac Hotel, are in the hands of the Detroit Rubber Group, and early information indicates an assured success for these events.

Tentative Rules for Papers

Papers will be received for this meeting under two new rules recently adopted by the Executive Committee as tentative measures to be tried out for the Detroit meeting. The rules are:

1. Submission: Each author planning to present a paper before the Division of Rubber Chemistry shall submit to the Secretary not later than July 13 the title of his paper together with three copies of an abstract of 200 to 250 words and an estimate of the time of presentation together with the name of the laboratory in which the work was done.

2. Approval: Each paper shall be approved by a Papers Committee, consisting of the editor of *Rubber Chemistry and Technology*, the Secretary, and a member of the Executive Committee appointed by the Chairman, before it is placed upon the final program.

Inasmuch as the judgment of the Papers Committee must be based entirely upon the abstract, it is important that it be not only concise, but comprehensive. The abstract should set forth the purpose of the work, the important results, and the conclusions. It is again urged that the utmost care be exercised to make lantern slides legible through use of large type, heavy lines, and limited data. At least one author of each paper presented must be a member of the A. C. S.

It is perfectly agreeable for the author to submit his completed manuscript by the date of the abstract deadline or any time thereafter up to the meeting. The earlier the completed manuscript is submitted, the more promptly, of course, will it be published. It is hoped that the membership will respond favorably to the new papers rules by submitting sufficient papers for a well-rounded program for the second day's meeting.

Charles Goodyear Lecture

As will be recalled, the Charles Goodyear Lecture and Award was created last fall in Boston, Mass. Inasmuch as the rules state that the nominations must be in the hands of the Secretary by November 15 of the year preceding that in which the lecture is to be given and because the time between the Boston meeting and that date was so short it was decided not to make any award for 1940. However, nominations for the 1941 Lecture may be sent to the division secretary, H. I. Cramer, University of Akron, Akron, O., now or at any time up to November 15.

The lecture is for the purpose of stimulating interest in fundamental research on rubber and to recognize those who have made outstanding contributions to the science of rubber or related subjects. Nominations should be accompanied by a statement setting forth the qualifications of the nominee, with specific reference to the research on which the nomination is based. The lecturer chosen will be notified of his selection prior to March 1 and will be given an honorarium of $200 ten days prior to the lecture, as well as a suitably inscribed certificate. Complete details on the lecture will be found in our February 1, 1940, issue, page 57.

Back Copies of *Rubber Chemistry and Technology*

There is a shortage of copies of the January, 1940, issue of *Rubber Chemistry and Technology*, and the treasurer, C. W. Christensen, will pay $1 for each copy received in good condition at his office, 1012 Second National Building, Akron, O.

Newly Organized Buffalo Group Holds First Meeting

ANOTHER important rubber manufacturing area of this country was brought into closer contact with the activities of the Division of Rubber Chemistry, A. C. S., when the newly organized Buffalo Group held its first meeting on June 4 at the Hotel Lenox, Buffalo, N. Y. This organization is the seventh local group to be formed under the auspices of the parent division. At dinner 69 members and guests were present; while the meeting which followed had an attendance of approximately 75.

John S. Plumb, of U. S. Rubber Reclaiming Co., Inc., who acted as temporary chairman of the organizing committee, was elected first chairman of the new group. Other officers elected at the meeting were: vice chairman, M. J. Berman, Hewitt Rubber Corp.; secretary-treasurer, Burt W. Wetherbee, Globe Woven Belting Co., Inc.; executive committee, M. L. Allard, U. S. Rubber Reclaiming Co., Inc., J. M. Cranz, J. M. Cranz Co. and Spray Dip Rubber Corp., and H. E. Elden, Dunlop Tire & Rubber Corp.

The Rubber Division was officially represented at the meeting by its chairman, E. B. Curtis, of R. T. Vanderbilt Co., who welcomed the new group as a new force in aiding the division's widespread activities. Mr. Curtis traced the development of the other local groups throughout the country, explaining the functions of these organizations and their relations to the parent division. That every worker in the manufacture and technology of rubber must strive toward keeping his efficiency at a maximum was emphasized by the speaker. The attainment of this goal, Mr. Curtis pointed out, could be aided by participation in the activities of the local group.

Entertainment was ably handled by H. Walter Grote, of the United Carbon Co., whose retinue of magic was enthusiastically received by those present. It was announced that preparations would be made during the summer for an interesting fall meeting.

Reclaim Symposium Held by Chicago Group

MEETING on June 7 at the Hotel Sherman, Chicago, Ill., the Chicago Group, Rubber Division, A. C. S., held a symposium on "Reclaim in a National Emergency." More than 125 members and guests attended this affair, arranged by J. Urech, of the Samuel Bingham's Son Mfg. Co.

The program was opened by the motion picture "It Might Happen Here," presented by G. K. Trimble, vice president, Midwest Rubber Reclaiming Co., which depicted the importance of reclaim should crude rubber supplies be curtailed. The speakers on the program and their topics were: E. B. Busenberg, chief chemist, Philadelphia Rubber Works Co., "The Use of Reclaim in the Tire Industry;" H. F. Palmer, chief chemist, Xylos Rubber Co., "The Use of Reclaim in Mechanical and Hard Rubber Goods;" and J. S. Plumb, factory manager, U. S. Rubber Reclaiming Co., Inc., "The Use of Reclaim in the Manufacturing of Sponge Rubber." The speakers discussed the use of reclaim in the industries under consideration and also pointed out the possibility for increased use of reclaim if it became necessary to extend crude rubber stocks in this country over a long period.

The group will hold an outing on Saturday, July 20, at the Lincolnshire Country Club, near Steger, Ill. Three 18-hole golf courses, two swimming pools, a baseball field, and tennis court will be available to the group. Golfers may start as early as they wish, and lunch a la carte will be served. The club may be reached by auto or by the Illinois Central Suburban train to Dixie Highway, where buses will provide transportation to the club. Reservations should be sent to B. W. Lewis, c/o Wishnick-Tumpeer, Inc., 6130 W. 51st St., Chicago, Ill.

Los Angeles Group Closes 1939-40 Season

THE Los Angeles Group, Rubber Division, A. C. S., held its last meeting of the 1939-40 season on June 4, at the Mayfair Hotel, Los Angeles, Calif., with 63 members and guests in attendance. The next meeting is scheduled for October 8.

The program of the June meeting was essentially non-technical. Two motion pictures were shown. One, "The Thirteen Golden Cities," presented by The Metropolitan Water District of California, showed scenes of construction along the 392 miles of the Colorado River Aqueduct. The other picture, which was in color, depicted the various summer and winter activities at Sun Valley and was shown through the courtesy of the Union Pacific Railway Co.

J. C. Herbert, general manager of the Los Angeles plant of The B. F. Goodrich Co., donated Maxecon garden hose as a door prize, which was won by G. W. Craig (U. S. Rubber). The special prize, a Miller "Imperial" tire, donated by the Miller Rubber Co., through K. K. Kantzer, West Coast district manager, was won by E. H. Lewis (Western Insulated Wire). Table favors, comprising Fabricoid note pads, were distributed by John Hoerger, of A. Schrader's Sons.

This year's annual fishing trip was scheduled to be held on June 21 and 22 with Lee Horchitz acting as chairman of the event.

New York Group Holds Successful Outing

PLENTY of sunshine, a beautiful location, and good food all contributed toward making this year's outing of the New York Group, Rubber Division, A. C. S., one of the most successful the group has ever held. The affair was held at the Green Meadow Club, Harrison, N. Y. No small measure of credit is due J. de C. Van Etten (Vansul), general outing chairman, and those who assisted him for so ably handling this affair. The outing, attended by 185 members and guests, got under way shortly after noon and was concluded in the early evening with a steak or fish dinner.

Those in charge of the various activities follow: *golf,* F. F. Salamon (Binney & Smith); *boccie,* J. H. Carroll (R. E. Carroll Co.); *tennis,* M. E. Lerner (*Rubber Age*); *horseshoes,* W. F. Lamela (Okonite); *darts,* S. C. Stillwagon (India Rubber World); *baseball throw,* A. J. Northam (Du Pont); *clock golf,* A. R. Kemp (Bell Laboratories); *soft ball,* J. Miscall (Flintkote); *tug-of-war,* L. D. Ackerman (Seamless Rubber); *beer,* L. D. Walker (Triangle Conduit); *registration,* W. G. Coe (*Rubber Age*), P. P. Murawski (Du Pont), B. B. Wilson (India Rubber World), P. P. Pinto (*Rubber Age*).

Prizes, purchased from group funds, and winners of the various events follow: *golf,* low gross, E. B. Curtis (Vanderbilt), golf bag; kicker's handicap, A. Partington (Passaic Rubber), handbag; consolation, A. C. Lindaw (American Cyanamid), golf balls; *boccie,* T. A. Bulifant (Barrett), shoes, and A. W. Browne (Barrett), sandwich grill; *tennis,* D. H. Comes (Farrel-Birmingham), tennis racquet, and John Ball (Vanderbilt), electric broiler; *horseshoes,* W. F. Lamela (Okonite), wrist watch, and B. W. Bender (U. S. Rubber), Silex; *darts,* W. C. Cooper (Imperial Paper & Color), airplane luggage, and W. F. Lamela, darts game; *baseball throw,* W. B. Atchison (Pequanoc), exposure meter, and A. J. Schoor (Vanderbilt), croquet set; *clock golf,* J. H. Nesbit (U. S. Rubber Reclaiming), electric drill, and W. F. Tuley (Naugatuck), Juice-O-Mat; *door prize,* L. J. Plumb (U. S. Rubber Reclaiming), portable radio.

Akron Group Outing

ON FRIDAY, June 14, the Akron Group, Rubber Division, A. C. S., held its annual summer outing at the Silver Lake Country Club, Akron, O. The affair was a complete success, largely through the efforts of the outing committee, headed by Jack B. Waite. The leading event was a golf tournament, with skeet shooting as an added attraction. Novelty entertainment outside of the clubhouse was arranged for those not playing golf. Donated prizes went to golf winners and lucky ticket holders.

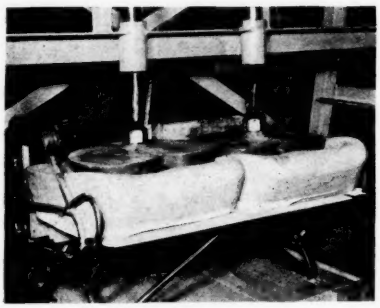
Boston Group Outing on July 19

THE annual summer outing of the Boston Group, Rubber Division, A. C. S., will be held in the afternoon and evening of Friday, July 19, at the Weston Golf Club, Weston, Mass., the scene of last year's successful outing. The club is on Wellesley St., opposite the Meadowbrook School. Wellesley

(*Continued on page* 61)

Taken at the New York Rubber Group Outing

New Machines and Appliances



"Jiggling Jenny"

Machine for Testing Latex Foam Cushion

IN THE testing of U. S. Royal (latex) Foam cushions, the "Jiggling Jenny," as it is known, simulates the up and down motion of a vehicle riding on rough pavements. The complete machine is made up of six testing units, each being of plow-seat shape and exerting a pressure of 150 pounds, which is representative of the weight of an average person.

In this test the cushions are subjected during 24 hours to 146,880 depressions to 50% of the unsprung cushion thickness. Although not conclusively proved, it is believed that this test represents from three to four years of actual service. The cushion is tested for density before and after the above test, and the per cent. change recorded. The density is determined on a device which records the pounds of pressure necessary to depress the cushion to 50% of its thickness, using a standard measured area. The cushion is visually inspected for surface and wall breaks and then judged bad, fair, good, or very good, depending upon the number of breaks and the change in density. United States Rubber Co., Mishawaka, Ind.

Bowes Hydraulic Valve

THE Bowes three-way valve is a lever-operated unit which may be mounted vertically or horizontally. The operating handle may be rotated through 360° so as to assume the most convenient position. A down stroke of the handle will exhaust pressure, and an upstroke will admit pressure. In principle, the Bowes valve comprises double-check valves mounted in one body. The upper check valve prevents the escape of water from the operated mechanism; while the lower check valve prevents the inlet pressure from reaching the operated mechanism.

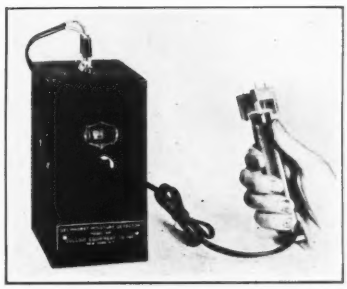
Pressure tightness is obtained by a comparatively soft disk which re-forms to the seat at every closure. These disks are shielded from the abrasive action of the water flow and are said to be self-cleaning during each operating cycle. Ease of operation is obtained by small pilot valves which utilize internal water pressure to open the main passages. Packings are not subject to pressure and therefore do not wear or leak, it is claimed. All mechanical wearing surfaces are of hardened steel. Seely Instrument Co., Inc., Akron, O.

Overload Release Clutch

AN OVERLOAD release disk clutch, designed to function in transmitting power as a fuse does in the transmission of electric current, embodies an automatic safety feature for the protection of mechanical parts. The clutch is engaged in the regular manner and smoothly transmits the allotted load. When an obstruction or excessive torque is encountered, however, the clutch immediately slips. After a fraction of a revolution of slippage the clutch disengages itself. A limit switch that acts off the clutch may also be used to disconnect the electrical equipment supplying power to the machine. The clutch, which can be set to transmit any torque from zero to its rated capacity, is adaptable to a variety of industrial machines and conveying systems where an obstruction might cause costly damage to the machine itself or to the product. The Conway Clutch Co.

Automatic Release Clutch

Bowes Three-Way Valve



Delmhorst Moisture Detector with Pin Electrodes

Moisture Detected by Electrical Resistance

THE moisture content of many materials, including crude rubber, may be measured on the Delmhorst moisture detector which utilizes the fact that the electrical resistance of a material is inversely proportional to the amount of moisture present. The electrical resistance of the material to be tested is measured between spaced electrodes, electrically connected to a dial indicating instrument based on the Wheatstone bridge principle of operation.

For solid materials spaced pin- or bayonet-type electrodes are used. The electrode pins are pressed into the material, the current turned on, and immediately the moisture content is indicated on the dial. For measuring the moisture content of thin sheet materials such as paper and treated fabrics, disk electrodes are used with the sheet placed between the disks. Powdered materials may be compressed in a cylinder and then measured in a similar manner. The dial scale of the instrument is graduated from 0 to 100, and the detector must be calibrated for each type of application. Use of the detector is limited to materials of relatively low conductivity. An important advantage of the new instrument, it is claimed, is its use for products of large size or for materials which cannot conveniently be measured by other methods of moisture determination. Portability, simplicity of design, and speed of measurement are said to be other advantages of the detector. Colloid Equipment Co., Inc.

New Goods and Specialties

Taylor Yachting Shoe

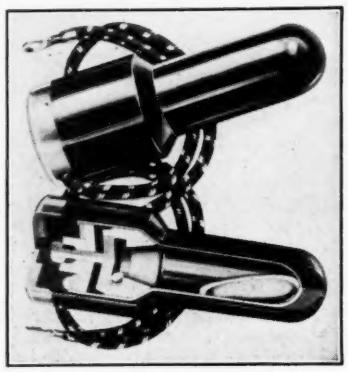
Anti-Slip Yachting Shoe

A CANVAS yachting shoe has a rubber sole with scorings that form a herringbone pattern, which are said to prevent definitely slipping on a wet deck. Each scoring acts as a squeegee when it strikes a wet surface, resulting in the anti-slip performance. Alex Taylor & Co., Inc.

Small Diameter Building Wire

A NEW insulated wire is said to double the wattage capacity of existing conduits in office buildings, apartment houses, and private homes. The increased conduit capacity is made possible by the thinner insulation obtained by the use of latex rather than milled rubber. The new wire for this purpose, which is essentially the same as has been previously used for communications and control systems, has been approved recently for branch electrical circuits by the Electrical Committee of the National Fire Protective Association. The new product, under the name U. S. Laytex, enables the rewiring of buildings for increased electrical capacity without the installation of new conduits. United States Rubber Co., 1230 Sixth Ave., New York, N. Y.

These new page protectors, introduced by Protex Products Co., are of transparent, tissue-thin Pliofilm with the three closed edges heat sealed and the open edge punched for a ring binder.



Rubber-Covered Durakool Mercury Switch

Rubber-covered Mercury Switch

A METAL-CLAD mercury switch is encased in rubber to provide protection against moisture and corrosive liquids and gases. The use of a metal container for the mercury instead of a glass envelope permits rough handling without breakage and also allows internal pressure far in excess of the limitations of glass for aid in quick reduction of the arc created when the circuit is open. The rubber covering is used on the standard unit when the added protection of the rubber is desired. Durakool, Inc.

Aircraft Propeller Mechanism Utilizes Neoprene Seal

A HYDRAULICALLY operated full-feathering propeller mechanism, which utilizes oil as a medium, permits adjustment of the propeller blades to a high pitch during flight in order to reduce propeller drag to a minimum when the engine is not operating. In the design of this mechanism it was necessary to choose a sealing material that would perform efficiently under variable operating conditions, and neoprene compounds were chosen for this purpose. The neoprene seals are required to hold oil under pressures varying from 50 to 400 pounds per square inch and at temperatures ranging from -50 to 150 F. Also the seals are called upon to operate under varying clearances, as the propeller mechanism is constructed of alloys of aluminum and steel, materials with widely varying coefficients of thermal expansion. Hamilton Standard Propellers, Division of United Aircraft Corp.

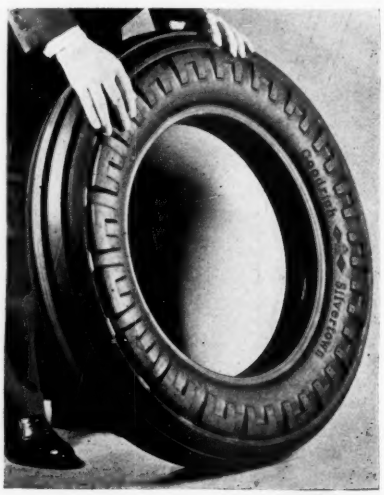
Laminated Linoleum Flooring Utilizes Layer of Rubber

A COMPOSITE floor covering, known as Nairn Treadlite De Luxe, comprises a top layer of inlaid linoleum pressed into a waterproofed layer of felt, a thin rubber cushion, and an adhesive backing. The rubber cushion between the adhesive backing and felt layer is said to prevent splitting as a result of movement of floor boards caused by expansion or contraction and also to provide additional resilience to the flooring. Congoleum-Nairn, Inc.

Cross-Sectional Diagram of Nairn Treadlite Flooring

Grader Tire for Use on Angle

THE "leaning wheel" tire has been developed for use on the free rolling wheels of road grading machines which operate in ditches, on inclines or embankments as well as on flat surfaces. A special-type axle on these graders permits the wheels to lean over on either side to provide stability in grading operations. For this purpose the new tire has been built with no definite dividing line between the tread and the side-walls, and thus it will ride naturally at any angle without undue wear or strain. The tread surface has a deep, circular, grooved tread to resist side-slip; while the side-walls have radial cleats to aid rotation of the wheels when working at an angle in mud. The tire is made in three sizes: 6.50-20, 7.50-24, and 8.25-24. The B. F. Goodrich Co., Akron, O.



Leaning Tire for Graders

UNITED STATES

Business Improves Here with Spread of War Abroad

The decline in industrial activity which began in December was checked in May with the intensification of hostilities in Europe. Most activity is evidenced in industries directly affected by the war, as machinery, aircraft, shipbuilding, and chemicals. Improvement has also been noted in meat packing, rayon production, petroleum, coal, tin plate operations (up to 78%), and steel (up to 87.7%, the highest for 1940). Fluctuations in output last month occurred in oil, power, lumber, cotton mills, and carloadings, all ending on an upward note.

Machine tool output, however, recently declined slightly. Leather footwear production also dropped, but indications are that output for the second half of 1940 would substantially exceed that of the first half. Output for the first five months is estimated at 165,106,000 pairs, against 178,768,000 pairs in the same period of 1939.

Automobile output rose steadily and contraseasonally early in June despite higher dealers' stocks; a decline set in later. A heavy June output and a sudden end to production of 1940 models were held possible. May factory sales of passenger cars and trucks were estimated at 404,700 units, 11% under that of April, but 29% above that of May, 1939. Output for the first five months of 1940 was 2,168,178 units, 25% above the figure for the 1939 period. Factory sales for the first five months of this year were exceeded only in 1929 and 1937.

The rubber industry in June operated at about the same level as in May. Tire demand, both replacement and original, to date is under last year's record figures, partly because of the unseasonal weather. Mechanical goods are fairly active, and footwear continues to be satisfactory. Insulated wire has begun to show some improvement. Rubber manufacturers' inventories are 10 to 15% higher than a year ago.

Industry, in general, reports employment increasing, with a lack of skilled labor. Inventories are being maintained at about the same levels as last month; precautions are being taken against a possible shortage of materials.

EASTERN AND SOUTHERN

Barrett Staff Additions

The Barrett Co., 40 Rector St., New York, N. Y., recently made the following additions to the staff of its rubber compounding materials department. F. E. Bell, Jr., formerly with the Bolta Co., Lawrence, Mass., was appointed technical representative in Ohio and the Midwest, making his home in Cuyahoga Falls, O. C. A. Meyer, formerly with the Firestone Rubber & Latex Products Co., Fall River, Mass., will represent the company in the East in the same capacity, with headquarters in New York. A. W. Browne, formerly with The B. F. Goodrich Co., Akron, O., has joined the technical staff of The Barrett Co.'s rubber service laboratories in Edgewater, N. J.

E. W. Colledge, G. S. A., Inc., supplier of chemicals, on June 1 moved its New York, N. Y., office to 52 Vanderbilt Ave.

Jos. Stokes Rubber Co., Trenton, N. J., has appointed Willard Kelly to its sales force. He was formerly with the Thermoid Co., Trenton, in the same capacity. The Stokes company reports that business is about 30% better than last year and that its Canadian plant has been operating to capacity for the past six months.

Modern Plastics Magazine, 122 E. 42nd St., New York, N. Y., is sponsoring the Fifth Annual Modern Plastics Competition, which closes on August 15. It is open to all companies using plastics for their products, to designers, to engineers, molders, laminators, fabricators, raw material suppliers, and machinery and mold manufacturers. Any object or product designed or placed on the market since September 1, 1939, is eligible. Entries will be grouped according to the type of application or the industry or field in which they are used, as follows: 1. Architecture; 2. Business and Office Equipment; 3. Communications; 4. Decorators' Accessories; 5. Furniture; 6. Household; 7. Lighting; 8. Machinery and Appliances (Industrial); 9. Novelties; 10. Scientific; 11. Sporting Goods, Games, and Toys; 12. Style and Fashion; 13. Transport; 14. Miscellaneous. There will be three awards of equal standing in each group. Winners will be announced in the October, 1940, issue of *Modern Plastics Magazine*, and prizes will be awarded at a dinner at the Waldorf-Astoria Hotel on October 15.

Lawrence M. Oakley, of the Essex Rubber Co., Trenton, N. J., returning from a business trip through New England, notes an improvement in business conditions.

CALENDAR

July 19.	Boston Rubber Group, Annual Outing, Weston Country Club, Weston, Mass.
July 20.	Chicago Rubber Group, Outing. Lincolnshire Country Club, near Steger, Ill.
Sept. 12-13.	Rubber Division, A. C. S. Annual Meeting. Book-Cadillac Hotel, Detroit.
Oct. 7-11.	National Safety Council. 29th Annual Safety Congress and Exposition. Stevens Hotel, Chicago.
Oct. 8	Los Angeles Rubber Group, Mayfair Hotel.
Oct. 12-19.	National Automobile Show, Grand Central Palace, New York.
Dec. 2-7.	14th National Exposition of Power & Mechanical Engineering. Grand Central Palace, New York.

Titanium Pigment Changes

President C. F. Garesché, of Titanium Pigment Corp., 111 Broadway, New York, N. Y., recently announced several changes in the executive staff that occurred last month. G. W. Corddry, eastern sales manager, was made general sales manager in place of I. D. Hagar, who will devote more time to executive duties. D. W. Edgerly, western sales manager, was elected a vice president of the company at the annual meeting on June 3, but he will still be connected with sales activities. His successor in his former post is K. W. Ericson, formerly in charge of sales in the Chicago area. R. S. Perry, Jr., sales representative in the Midwest, was appointed assistant sales manager of the corporation, with headquarters in New York. Transferred to the new western sales office at 104 S. Michigan Ave., Chicago, were H. L. Jungmann, sales office manager at St. Louis, and E. L. Eliot, from the New York office, who will be a sales representative in the western territory. New sales representative for the Ohio district is H. E. Bottemiller, formerly with Cook Paint & Varnish Co.

Elected directors at the annual meeting were Mr. Corddry and L. G. Reichhard, production manager of National Lead Co., 111 Broadway, New York.

Continental Carbon Co., 295 Madison Ave., New York, N. Y., to help supply the ever-increasing demand for its carbon blacks since the construction of its extensive Sunray, Tex., plant four years ago, has added ten additional tank cars from General American Transportation Corp.

The Rubber Manufacturers' Association of New Jersey held its annual outing on June 25 at the Trenton Country Club, where golf, tennis, and other games were enjoyed, followed by dinner in the evening. Members from all over the state attended. A. Boyd Cornell, of the Hamilton Rubber Mfg. Co., Trenton, was in charge.

American Cyanamid & Chemical Corp., 30 Rockefeller Plaza, New York, N. Y., will erect a half-million dollar factory at Wallingford, Conn., for the manufacture of resins for plastics and other purposes. The new factory, construction of which will start some time this year, will be the first unit in a large development expected to extend over a ten-year period.

L. Albert & Son, supplier of rubber machinery, reports its three plants at Trenton, Akron, and Los Angeles are very busy. I. H. Albert has gone to California to take charge of the company's business until early fall.

Vulcanized Rubber Co., Morrisville, Pa., finds business has improved over previous months.

United States Department of Labor, Washington, D. C., includes the following in its recent listings of government supply contracts awarded; CAA: *cable,* Anaconda Wire & Cable Co., New York, N. Y., $63,450; NAVY: *cable,* Anaconda, $13,845; *gaskets,* Garlock Packing Co., Palmyra, N. Y., $14,136; WAR: *batteries,* Electric Storage Battery Co., New York, $14,660; *cable and reels,* General Cable Corp., New York, $58,005; *raincoats (rubberized),* Sigmund Eisner Co., Red Bank, N. J., $103,000; *wire,* Acorn Insulated Wire Co., Inc., New York, $141,600, Phelps Dodge Copper Products Corp., Habirshaw Cable & Wire Division, New York, $513,744.

Near Para Rubber Co., Trenton, N. J., reports increased demand for reclaimed rubber.

The American Society of Mechanical Engineers, 29 W. 39th St., New York, N. Y., one of the sponsors who assisted in developing the American Standard Safety Code for Elevators, Dumbwaiters and Escalators, has announced that, as from time to time new regulations and ordinances are being adopted or old ones extensively revised, it is important that this code be at all times as accurate and up-to-date as possible. The first edition, issued in 1921, has been revised thrice through the research and efforts of Sectional Committee A17, organized under the procedure of the American Standards Association, and with the assistance of its Subcommittee on Research, Recommendations and Interpretations. Since publication of the fourth edition of the code in 1937, however, the clarification of certain rules, revisions, and the addition of new material seem necessary. Consequently the Sectional Committee and its subcommittee plan to issue a pamphlet covering these points. All persons connected with the use of elevators, both passenger and freight, as well as their manufacture and installation are therefore urged to send any comments or criticisms to the Secretary of the Subcommittee, care of The American Society of Mechanical Engineers, at the above address no later than September 1, 1940.

Dr. H. Mark

Authority on High Polymers

Herman F. Mark was born on May 3, 1895, in Vienna, Austria, and educated there. He received his Ph.D. from the University of Vienna in June, 1921. The next year he joined the Kaiser Wilhelm Society in Dahlem, Germany, as a research assistant. He worked there in the two institutes of F. Haber and R. O. Herzog on X-ray investigations of organic crystals, fibers, and other high polymeric substances and on the production of staple fiber. Mr. Mark also wrote a book on the "X-Ray Investigation of Crystals."

Then in 1926 he went to the I. G. Farbenindustrie as head of a research laboratory at the Ludwigshafen on the Rhine plant. Here he worked on cellulose and its derivatives, synthetic rubber, polystyrene, polyvinyl chloride, and their different copolymers. He collaborated with K. H. Meyer in writing "High Polymers" and also took out about a dozen patents in the same field.

In 1932, Dr. Mark was appointed professor of chemistry and director of the first Chemical Institute at the University of Vienna and engaged in the mechanism of polymerization reactions and the structure of natural and synthetic high polymers. During his stay at the university he authored three books, "X-Ray Investigations of the Structure of Matter," "Electronic Diffraction," and "Physics and Chemistry of Cellulose."

When Austria was absorbed by the Reich in 1938, Dr. Mark went to Canada and was made research manager of the Canadian International Paper Co., Hawkesbury, Ont., and conducted technical research on wood cellulose. He resigned this position recently to accept the post of adjunct professor for organic chemistry at the Polytechnic Institute of Brooklyn, where he will lecture on the general physico-chemical aspects of organic chemistry, on cellulose, and on rubber. Dr. Mark intends to continue his research work on rubber elasticity and the kinetics of polymerization reactions.

He belongs to the American Chemical, Faraday, and Kaiser Wilhelm Institute societies, Pulp & Paper Association, and the Academy of Science in Vienna and Budapest and is an honorary member of the chemical societies of Madrid and of Bucharest. He is also interested in skiing, tennis, fishing, and soccer.

Dr. Mark is married and has two sons.

David Schrage, president of the Lithuanian Rubber Mfrs., Inkaras, A.B., Kaunas, Lithuania, and of the Gentleman Rubber Co., Lodz, Poland, arrived in New York on May 29 on a business trip for the Lithuanian concern. After a few days in Canada, he returned to the United States on June 9, where he expects to remain until the end of July before sailing for London. Mr. Schrage is stopping at the Salisbury Hotel, 123 W. 57th St., New York, N. Y.

Thiokol Corp., Trenton, N. J., is experiencing a busy season in all its products.

Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc., Passaic, N. J., according to General Manager F. L. Curtis has arranged for employe life insurance exceeding $2,500,000 supplemented by sickness and accident benefits. In this group insurance program underwritten by the Metropolitan Life Insurance Co., employes contribute fixed amounts, and the employer pays the balance of the entire net cost. Eligible employes enrolled in the plan each receive $1,000 life insurance; general workers in the plant will be paid a weekly benefit of $10 in case of sickness or non-occupational injury. Also included in the plan are special services as visiting nurse care and the distribution of pamphlets on health conservation and disease prevention.

National Industrial Conference Board, 247 Park Ave., New York, N. Y., recently elected as chairman Col. David M. Goodrich, chairman of the board, The B. F. Goodrich Co., Akron, O.

Luzerne Rubber Co., Trenton, N. J., announced an increase in orders.

Edward R. Allen, technical director, Krebs Pigments Department, E. I. du Pont de Nemours & Co., Inc., Newark, N. J., recently was elected a councilor of The American Institute of Chemists.

Plant Rubber & Asbestos Works, 537 Brannan St., San Francisco, Calif., has made Albert J. Stream assistant general manager. With the company eleven years, he has served as salesman in Los Angeles, district manager in Dallas and Oakland, and manager of the contract department.

MIDWEST

Arthur Daniels *(Right)* Holding an Unused 1918 U. S. Tire; While Charles Daniels *(Left)* Exhibits a Current Model

1918 vs. 1940 Tire

Daniel Bros. Service, U. S. Tire dealers, Des Moines, Iowa, when recently vacating its old premises, found in a broken partition of a wall a brand-new U. S. tire built in 1918, size 36x4½, for which the customer in those days paid about $48 and expected a life of 3,000 miles. Daniel Bros., in an effective advertising display, contrasts this old-fashioned casing with a 1940 model, a U. S. Royal DeLuxe, 6.50x16, which retails at about $15 and should last about 20,000 miles.

Monsanto Chemical Co., St. Louis, Mo., according to instructions issued June 8 to its 13 American plants by Charles Belknap, executive vice president, will permit all employes who are members of the National Guard to devote three weeks to training with their units this summer without loss of income. As all employes, both on salary and on hourly rates, regularly receive two weeks' vacation with pay if they have had one year's service at January 1 of each year, those so requesting will be granted a third week's leave to be devoted to National Guard duty, and Monsanto will make up the difference between the employe's pay and allowance for military duty and the amount he would receive from the company for a normal work week. Employes entitled to a vacation of two weeks with pay who belong to the National Guard will be allowed to take their vacations at the time their guard units are to train.

Brown Rubber Co., Inc., manufacturer of molded and sponge rubber products, Lafayette, Ind., at its recent annual meeting elected the following directors: E. A. Callanan, Russell McGee, Robert C. Rand, Murray D. Safanie, and L. E. Wakelee. Officers elected follow: president and treasurer, Mr. Callanan; secretary and assistant treasurer, D. Schultz; assistant secretary, H. T. Holsapple. The stockholders also approved and ratified the compensation agreement between the board and the president. Mr. Callanan stated that the first four months of 1940 showed a 61% gain in sales, resulting in satisfactory profits compared with losses for the early part of 1939.

Amity Leather Products Co., West Bend, Wis., manufacturer of leather goods, according to Joseph M. Kaplan, president of Comprehensive Fabrics, Inc., 37 W. 27th St., New York, N. Y., is the most recent licensee for The B. F. Goodrich Co.'s koroseal coating for fabrics. Two items, each with a koroseal-coated lining, Rolf's Fitall, a new automatic travel kit, and a tobacco pouch, are already being manufactured for the fall wholesale trade.

Better Business Bureau of St. Louis, Inc., Arcade Bldg., St. Louis, Mo., has proposed a set of standards which have been accepted by the *Post-Dispatch,* the *Globe-Democrat,* and the *Star-Times* as the censorship rules to govern the acceptance of tire advertising. Important points of the standards follow. The list price of a tire or tube of a better grade in the same manufacturer's line shall not be used in comparison with the advertised sale price as a means of computing the savings. The list price of another manufacturer's tire or tube of similar size, construction, etc., shall not be used in comparison with the advertised sale price of a tire or tube. A so-called list price shall not be used in comparison with the advertised sale price except when the price used for comparison is the regular price for which the tire or tube was normally sold by the advertiser prior to the special sale. An advertised price or stated saving effective only when the consumer purchases one or more other tires or tubes at the regular price may be used only when such conditions are prominently and fully explained.

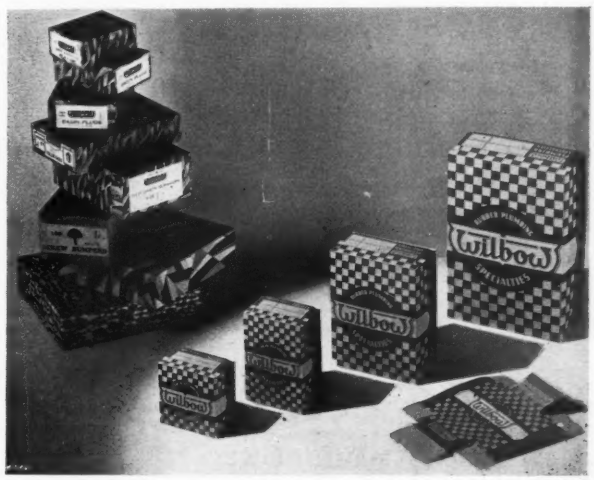
Williams-Bowman Rubber Co., Cicero, Ill., recently adopted a new and simplified packaging program for its 3,800 "Wilbow" rubber plumbing specialties. Developed by T. Barry Hodge, Ltd., Chicago, Ill., this new packaging plan offers the following advantages to both manufacturer and dealers: uniformity of design with greater merchandising appeal; fewer sizes of packages required, four instead of eight; simplification of shipping and handling; savings in time, space, and labor; and knocked-down construction of the two-piece yellow and blue boxes, effecting savings in storage space.

Midland Rubber to Move

Midland Rubber Co., 207-211 A Ave., N. E., Cedar Rapids, Iowa, recently purchased a 20-acre tract on the outskirts of the city limits where it will build four units 150 by 60 feet to form a hollow square. Each building will be one story, having sloping roof with a monitor 20 feet wide extending the full length of the building; the roof will be supported by steel trusses and have no supporting columns. The first unit is expected to be ready for occupancy in early August, and new presses and calender equipment will be installed before the company ceases operations at its present location. Such a course is necessary to prevent interruption of production and to handle increasing demand for the company's products. The present plant has been running to capacity day and night since January 1, 1940, with enough orders on hand to require this schedule until the end of July at least.

Midland Rubber, which started in 1937, has confined its efforts to the manufacture of molded items of which rubber covered tractor steering wheels constitute a large part. Other products include flexible pipe joints, industrial truck casters, pump valves, motor mountings, blocks, slabs in rubber and synthetic rubber, and sponge rubber sheets and pads.

Officers of the company follow: president and general manager, B. A. Ruhling; vice president, I. Irl Tubbs; and secretary-treasurer, J. Scott McIntyre.



The New *(Right)* "Wilbow" Packages Contrasted with the Old *(Left)*

OHIO

Goodyear Announcements

The Goodyear Tire & Rubber Co., Akron, each year sponsors two all-expense excursions for its employes, one in the spring, the other in the fall. Late in May occurred the spring trip, which covered Washington, D. C., and Colonial Virginia. Scheduled for September is a visit to the World's Fair in New York.

Personnel Mention

President Paul W. Litchfield on June 21 announced the appointment of Russell DeYoung as assistant to the president of Goodyear Aircraft Corp. and of Goodyear Foreign Operations, Inc. Mr. DeYoung, who at 31 is the youngest member of Goodyear management, joined the company in 1928 while taking the co-op engineering course at Akron University. After commencement in 1932 he started on the Goodyear Production Squadron, graduating in 1934. After a short time on tube room supervision, he went as one of the squadron group to start production of the Buitenzorg, Java, plant. He returned in 1936 to work in the tube room for a year before transferring to the development division. Lately Mr. DeYoung was on a leave of absence from Goodyear while he attended Massachusetts Institute of Technology for the master's degree he won this June.

Fred W. Climer, Goodyear personnel director, has announced the promotion of Nelson G. Ball as personnel manager of the company's Jackson plant.

At the annual international convention of the National Association of Purchasing Agents, held in Cincinnati, June 3-6, George E. Price, Jr., Goodyear purchasing agent, was elected president of the association.

Ray P. Dinsmore, manager of the development and research departments at Goodyear, on June 3 was awarded an honorary degree of doctor of engineering by the Case School of Applied Science at its commencement exercises in Severance Hall, Cleveland.

New Air Hose

Goodyear is now marketing the new Red Wing air hose, designed especially for heavy-duty pneumatic tool service. The hose is available in three sizes: ½-, ¾-, and one-inch.

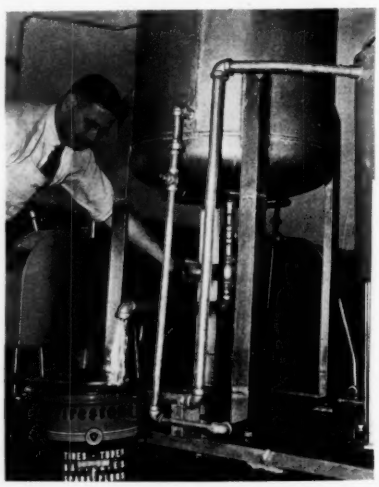
"Little World's Fair of Rubber"

Installed early last year for the Goodyear Home Coming Celebration and left intact because of the wide interest it attracted, the "Little World's Fair of Rubber" in Goodyear Hall, Akron, has been seen by more than 100,000 visitors. The exhibit, comprising 45 sections, includes a miniature rubber plantation with several trees from the company plantation in Costa Rica, which are publicly tapped for latex; a huge diorama which realistically portrays the former stretch of Arizona desert that today is Litchfield Park and the Southwest Cotton Co., a Goodyear auxiliary; raw materials; finished products; production processes; and company activities. The "fair" is open daily from 11:00 to 5:00, except on Saturday and Sunday. But by special arrangement it will be opened any week night for delegations from schools, churches, and other organizations.

Aerial Traffic Signals

Goodyear is manufacturing for Hollywood motion picture producers balloons sent aloft to warn commercial aircraft to avoid the vicinity of sound stages. Inspired by the London air raid defense balloon barrage, after many "takes" were spoiled when the roar of engines of planes flying overhead was picked up by the sensitive recording apparatus, these spherical balloons are painted a vivid orange; each has nearly a hundred highly polished, light weight metal reflecting disks about four inches in diameter secured to its surface at regular intervals. The balloons are 12 feet in diameter, can be inflated with 950 cubic feet of helium gas, and will be tethered on rope flying lines 400 feet long so that they may be raised or lowered at will. Goodyear has turned out more than 1,000 military and racing balloons in the last 15 years.

The Standard Chemical Co., Akron, through C. J. Harwick, has announced the appointment of Walter C. Weller, of the Weller Chemical Co., 141 Milk St., Boston, Mass., as New England representative for the extensive line of rubber compounding ingredients made and controlled by the Standard Chemical Co.



Here is shown part of the equipment used now in the process of manufacturing Buna rubber at The Firestone Tire & Rubber Co. plants in Akron. Polymerized synthetic rubber is emerging from the vessel in the form of latex, prior to coagulation. Buna is in regular production at the Firestone plants under license obtained from Standard Oil Co. of New Jersey, and the rubber company is said to have plans for a new plant capable of large-scale production

Goodrich Personnel Changes

The B. F. Goodrich Co., Akron, through Charles B. O'Connor, general sales manager of the tire division, has announced reorganization of duties of the executive sales staff of the division. Joseph A. Hoban, former manager of retail sales, has been named to the new post of merchandise manager of the division. Assistant merchandise manager is Willis C. Behoteguy, succeeded in his previous position of manager of the automobile tire department by the assistant manager, Chester T. Morledge. Wilson C. Bray, manager of truck and bus tire sales, is now sales manager of the tire division, succeeding Robert McTammany, who recently retired because of ill health. Mr. Bray was succeeded by Joseph E. Powers, formerly New York district manager. Guy Gundaker, Jr., was appointed to a new post, manager of budget sales, and L. A. Rosenberg, operating manager of the retail department.

Bullet-Proof Inner Tube

Through John L. Collyer, president, Goodrich recently announced that the bullet-proof inner tube made by the firm is an adaptation of the "Sealomatic" tube used for passenger car tires. Triple layers of special rubber compounds, the innermost of which is semi-viscous, give the military tube the ability to seal bullet holes without any sizable loss of pressure.

Research Papers for A.A.A.S. Symposium

W. F. Busse and B. S. Garvey, Jr., will participate in a research symposium sponsored by the American Association for the Advancement of Science, the week of July 8 at Gibson Island, near Baltimore, Md. Dr. Busse, director of physical research at Goodrich, will discuss "The Effects of Temperature on Some Physical Properties of Rubber," based on researches in the Goodrich laboratories and covering results now being applied in the study of the structure of rubber molecules and in the use of rubber in street car springs and other new developments.

Dr. Garvey, a Goodrich research chemist, will present "Mixed Polymers and Vulcanizable Plasticizers," which will review several of the latest synthetic developments, particularly some new products which, while not elastic like rubber, may have much use in the paint and the plastics industries.

The Firestone Tire & Rubber Co., Akron, honored more than a hundred Firestone athletes on winning teams in the various sports at an annual athletic banquet at the Club House on May 14.

CANADA

Canada's raw rubber imports during April, according to the Dominion Bureau of Statistics, totaled 6,856,788 pounds, value $1,432,385, against 3,284,596 pounds, value $505,723, in April, 1939. The Straits Settlements sent 6,257,976 pounds, the United States 343,422 pounds, and Ceylon 255,390 pounds.

Montreal tire dealers, with motoring at its height, report an above-normal demand for replacements and state that in anticipation of higher prices which may be occasioned by taxation for war purposes, owners of both cars and trucks are replenishing and in some instances stocking up, especially operators of truck fleets. Higher cost of raw materials, shortage of labor, and shipping difficulties due to the war are counted on, with probably higher taxes, to increase prices. Collections are reported fair throughout the trade. It is thought that the growing demand for tractor tires for farmers will lead to steadily increasing business from rural communities. In fields distant from older settlements a growing demand for cars, trucks, and buses is found. Greatest demand, tire dealers report, is for the 600-16 passenger tire, now used by about a score of different automobile makes of medium price. Throughout the winter business was steady, and improvement set in early in the spring and is counted on to continue owing to increased employment and the higher wages already accorded in some industries.

The old-fashioned india rubber tobacco pouch, despite the competition of pouches of leather, silk, and various fabrics, maintains its popularity with Canadian pipe smokers by a long lead, Montreal tobacconists declared, reporting sale of a record number of first-grade rubber pouches as "Father's Day" gifts.

Rubber workers have been taking a prominent part in the campaign launched by the City of Kitchener, Ont., to raise $50,000 for the purchase of a tank for the Overseas Forces. The fund, already halfway towards its objective, is largely composed of small individual subscriptions from humble citizens.

Some Montreal dairy companies, desirous of refraining from awakening sleeping customers, have equipped their horse-drawn vehicles with pneumatic rubber tires. The horses, however, have not been shod with rubber shoes.

Dominion Department of Munitions & Supply includes in contracts recently awarded the following: Canadian Fire Hose Co., Ltd., $9,960; Goodyear Tire & Rubber Co. of Canada, Ltd., $446,827.30; Dunlop Tire & Rubber Goods Co., Ltd., $171,313.76; and Firestone Tire & Rubber Co., Ltd., $464,126.

Canadian Industries, Ltd., Montreal, reviewing the products of chemical industry in Canada, stresses the importance of various processes for producing rubberized materials. Rubber-coated textiles are used for hospital sheeting, truck seating, tobacco pouches, and insoles for shoes. Dyed or colorless, the rubber compound is forced under pressure on linen or cotton backing, and two materials may be laminated together with the rubber in between. A variation of this process, using dyed cotton "flock," produces the suede finish of a product called "Doe-Tex" from which hats, sports jackets, windbreakers, slippers, and ladies' handbags are made. There is also a limitless range of color for belts, slippers, and shoes. The large number of rubber-coated fabrics includes not only "Doe-Tex" with its many shades of simulated suede, but "Dupletex," which is two cloths in one. This material will be much in evidence in rainy weather in the form of gaily patterned raincoats, some in blue, green, or white, others in gingham checks or plaid. Whether it rains or not, men will be sporting smart reversible coats of simulated Scottish tweed and various patterned jersey. These have the topcoat effect on one side for use in fair weather, and a trench coat styling on the other.

The Goodyear Tire & Rubber Co. of Canada, Ltd., New Toronto, Ont., is understood to have purchased in recent weeks sufficient of the outstanding preferred shares to use up $250,000 of the sinking fund reserve accumulated for this purpose. Under the provisions securing the preferred issue, a sinking fund of 8% of the annual net profits, limited, to an amount not exceeding $60,000, is provided for redemption of preferred stock at $52.50 a share plus accrued dividend.

The Miner Rubber Co., Ltd., Granby, P. Q., has introduced a new range of fashionable rubber footwear under the name "Regal." This new departure was developed following the honor done to the company by Her Majesty Queen Elizabeth's selection of Miner overshoes at the Wembley exhibition last year. Elaborate display cards have been prepared to feature this new line, bearing the caption "The Queen's Choice." The new Miner "Eve-n-braid" process of attaching fur trimming to the overshoes is also featured in the display.

Firestone Cotton Mills of Canada, Ltd., recently established a plant for making tire fabrics at Woodstock.

Fred C. Irwin, of Canada Wire & Cable Co., Ltd., Toronto, Ont., at the annual international convention of the National Association of Purchasing Agents held in Cincinnati, O., early last month was elected one of nine district vice presidents and as such will be a member of the executive committee for 1940-41.

Boston Group

(*Continued from page* 54)

St. is directly accessible from Routes 9, 20, and 30. These routes are crossed by Route 128, which leads from Route 1. From Boston, the best way is via Commonwealth Ave. (Route 30.)

J. L. Haas, Hodgman Rubber Co., is chairman of the outing committee, and he will be assisted by the officers of the group. Activities for the day will include golf, softball, tennis, bowling, and darts, with prizes going to the winners. A steak or lobster dinner will be served at 7:00 p.m. Those who plan to attend are urged to notify D. D. Wright, group secretary-treasurer, Hood Rubber Co., Watertown, Mass. Dinner tickets are $2 for members and $3 for non-members.

Section Elections

The Akron Section, A. C. S., last month held its election of officers. Chairman is W. T. Burt, of The B. F. Goodrich Co., succeeding Dr. R. F. Dunbrook, of the Firestone Tire & Rubber Co., who becomes a counsellor. Vice chairman is Dr. Winfield Scott, Goodyear Tire & Rubber Co.; secretary, Prof. E. G. Haas, Akron University; treasurer, Dr. A. M. Clifford, Goodyear.

F. D. Snell, head of Foster D. Snell, Inc., which features every form of chemical service, 305 Washington St., Brooklyn, N. Y., has been reelected a national councilor of the New York Section, A. C. S. Cornelia T. Snell, of the same firm, has been reelected secretary and a director of the New York Section.

R. H. Gerke, of General Laboratories, United States Rubber Co., Passaic, N. J., has been reelected a national councilor of the North Jersey Section, A. C. S.

Harry L. Fisher, of the research laboratory of U. S. Industrial Alcohol Co., Stamford, Conn., recently was elected president of The American Institute of Chemists and chairman of the Western Connecticut Section, A. C. S.

Rhode Island Club Meeting

THE Wannamoisett Country Club, Rumford, R. I., was the setting for the Rhode Island Rubber Club's summer meeting on June 21. The occasion featured an afternoon of golf with prizes for the winners and a talk by Dr. Theodore Collier, of Brown University, on "What Is the War About?"

At dinner 85 were present; while 85 golfers took part in the tournament. The winners were: *low gross,* F. F. Salaman (Binney & Smith), R. Newell (Respro), J. W. Morrissey (Hookless Fastener); *low net,* R. Cowan (Quabaug) tied with J. Mason (Quabaug), W. Shaw (Shaw Motors), and T. Durkin (Merchant & Miners); *kicker,* E. L. Hanna (Davol),

(*Continued on page* 67)

FROM OUR COLUMNS

50 Years Ago—July, 1890

In almost every factory in the United States ground cork has been combined with India rubber. (p. 224)

Para rubber comes to this country in cases made of pine, well bound with iron. (p. 224)

"Magallan, a worthy descendant of the great navigator, proposed a more effectual and convenient eraser in the shape of a piece of rubber." [From a history of the Academy of Sciences in Paris for 1752.] (p. 226)

Mr. George B. Thomson writes that he has no doubt but that the rubber tree could be cultivated to advantage in the low lands of the Sandwich Islands. (p. 227)

As far as we know, rubber sponges have not been made successfully at any time in this country, perhaps, as much as anything else, because there has been no great call for them. (p. 229)

Rubber paints that are said to be especially successful in resisting the action of moisture, snow, salt air and water, also fumes from coal, gas, etc., are made in Brooklyn at the Ingersoll Paint Works. (p. 233)

25 Years Ago—July, 1915

No one in the United States wants war. And that is the reason why many well-balanced people urge that we get so ready for war that no one will feel at all disposed to start one with us. (p. 529)

The first rubber mill was built in Russia soon after 1830. Fourteen years later, in 1844, another factory was built. (p. 533)

An important development in fountain pen construction is the introduction of a pen, having a pneumatic device for filling it direct from the ink supply. By simply raising and lowering a small lever on the side of the pen, with the point in the ink, the barrel is filled. (p. 540)

The Boston Belting Co. is about to equip a laboratory and testing department at its works. The equipment will include the original table used by Goodyear in his studies and experiments. (p. 550)

Together with the late Theodore S. Bassett, Max Loewenthal founded the United States Rubber Reclaiming Works, at Shelton, Conn., in 1895. In 1900 this company was merged with the Loewenthal Rubber Co., of Jersey City, and the combined corporation, under its present name, the U. S. Rubber Reclaiming Co., Inc., was moved to Buffalo, N. Y. (p. 556)

In tires, the combined output of the Akron factories has been for some time, at the rate of 30,000 tires a day, fully one-third greater than at the same time last year. (p. 562)

OBITUARY

W. A. Harshaw

AFTER a lengthy illness William Andrew Harshaw, chairman of the board and founder of The Harshaw Chemical Co., 1945 E. 97th St., Cleveland, O., died on June 4. Born in Dodgeville, Iowa, 78 years ago, Mr. Harshaw began his career in the drugs and chemicals field in 1881. After working for several firms the deceased in 1892 started his own concern of chemical merchants and brokers, Cleveland Commercial Co., reorganized in 1898 as Harshaw, Fuller & Goodwin Co. Mr. Harshaw was president until 1924 and chairman of the board until 1929 when the present name of the concern was adopted. Then Mr. Harshaw served as president until 1936, when he became chairman.

He was a trustee of the Case School of Applied Science, belonged to the American Chemical Society, the Chemists' Club of New York, and the Union, Mayfield Country, and the Chagrin Valley Hunt clubs, and was prominent in the Cleveland Chamber of Commerce and many other civic activities.

Survivors include his wife, three daughters, and two sons, one of whom, Wm. J., is president of the Harshaw company.

H. M. Bacon

AFTER a long illness Harwood Mumford Bacon, identified with the rubber industry since 1911, died in Shaker Heights, Cleveland, O., on May 22. Born in Charlotte, Mich., August 31, 1873, he attended grade and high schools in Detroit. There he became interested in motor cars and for some time was connected with the industry.

In 1911, however, he joined the Diamond Rubber Co., Akron, O., and three years later, following the merger with The B. F. Goodrich Co., in 1912, assumed full charge of sales of Diamond tires and accessories. But Mr. Bacon resigned in August, 1919, to become sales manager of the McGraw Tire & Rubber Co., Cleveland. Then in 1922 he returned to Goodrich as special sales representative. He also served for a while as Pacific Coast district manager for the company. When he retired in 1930 he had been manufacturers' equipment sales representative in Cleveland.

The deceased belonged to the Akron Portage Country and the Question clubs.

Survivors include his wife and a son.

Funeral services were held on May 24 in Detroit, with burial in Woodlawn.

Charles S. Moomy

AFTER a long illness Charles S. Moomy, founder and, until last fall, president of the Carlisle Tire & Rubber Co., Carlisle, Pa., died there June 19. As a young man, the deceased, born in Erie, Pa., May 11, 1880, became active in the sales department of the Keystone Rubber Mfg. Co., Erie, of which his father was founder and president. In 1917, Charles Moomy resigned from the Keystone company, of which he then was vice president and sales manager, and formed the Carlisle concern, specializing in the manufacture of inner tubes.

For years he belonged to The Rubber Manufacturers Association, Inc., and was active in industry affairs. He was also prominent in civic and philanthropic work in Carlisle, where funeral services were held on June 21.

He is survived by his wife, a son, a granddaughter, two brothers, and three sisters.

J. H. Richardson

JOHN H. RICHARDSON, 66, head of the research department and an assistant vice president of the United Shoe Machinery Corp., Boston, Mass., died June 2 of a heart attack in Melrose Highlands, Mass. Founder and head of the Richardson McKay Shoe Machinery Co., which made the McKay sewing machine that his father had invented, the deceased in 1908 sold his interest to the Boston concern and joined its organization, supervising the production of his machine. He was later transferred to the research department.

Mr. Richardson leaves his wife, a son, and a grandson.

BRAZIL

Press reports from Rio de Janeiro indicate that Brazil will try to redevelop its rubber growing industry, which once supplied much of the world's natural rubber. It is also reported that President G. Vargas announced that the government had decided to repopulate the rubber zones in the Amazonas territory by issuing land grants and subsidies to prospective colonists. This move, it is held, resulted from a belief that cultivation and sale of rubber from this territory will prove profitable because of the current high prices of the commodity. The fate of Netherland India also has been mentioned as a possible factor.

EUROPE

GREAT BRITAIN

Waste Rubber Utilized

War conditions are forcing the need of fuller utilization of all available materials. Consequently renewed interest is being shown here in the possibilities of scrap, waste, and old rubber.

Recently F. N. Pickett read a paper on "Distillation Products from Waste Rubber" before the London Section of the Institution of the Rubber Industry. Mr. Pickett explained that in 1930 it was discovered during experiments on new systems of reclaiming waste rubber that the products resulting from the destructive distillation of old tires possessed hitherto unsuspected solvent and softening properties. A complete system of reclaiming rubber, based on this discovery, was worked out at the time and patented, and many tons of reclaimed rubber were manufactured utilizing these distillation products.

Retort distillation was the method followed, and the distillation products proved to consist of an evil-smelling oil, somewhat resembling crude oil, and a certain proportion of non-condensable gas containing a light fraction which could be collected by passing the gas through activated carbon.

Fractional distillation showed that the rubber oil differs fundamentally from either petroleum or coal tar products: distillates did not divide themselves into any recognizable groups. In rubber oil the rate of distillation appeared to be constant from atmospheric temperature up to 400° C., and the properties of the various constituents varied little for fractions taken off at a lower or higher temperature except that the light volatile fractions distilling below 150° C. appeared to have but slight softening effect on vulcanized rubber and no solvent action; whereas the heavier fraction has a definite solvent and softening effect on vulcanized rubber. Consequently it was decided to fractionate the oil into light and heavy oils. Fractions distilling below 170° C. are called light rubber oil, and the fractions above this, heavy rubber oil. The latter, after deodorization, was used as a reclaiming oil, with satisfactory results.

The light oil was further rectified and found to be exceedingly useful as a solvent for crude rubber. The fraction distilling between 70 and 140° C. and corresponding to a light benzol proved to be a very rapid, apparently non-toxic solvent. Unlike other solvents, it had the advantage of being extremely kind to the skin of persons working with it; consequently it is held that this light fraction would undoubtedly find a use in dry shampoos and other similar toilet preparations which require volatile solvents. It also makes a very good cleaning solvent for clothing, appears to eliminate knocking when mixed with ordinary petrol for use as motor fuel, and, finally, does not seem so inflammable and explosive as benzol.

The yields obtained from old tires follow: steel scrap from beads, about 15%; crude rubber oil by distillation, 25%; carbon and other residue, 60%. The cost of distillation for crude oil was estimated at 3d. per gallon; rectification added a further 4d. per gallon. In this calculation credit is taken for scrap steel and the carbon residue; the latter on briquetting gave an excellent substitute for steam coal, being of high calorific value and practically smokeless.

In conclusion Mr. Pickett stated his belief that while distillation of waste rubber on a national scale was not a workable proposition, yet it probably had interest for certain branches of the rubber industry, for instance proofing, and it undoubtedly would be of use to the cosmetic industry. The heavy rubber oil could take the place of imported pine oil and might give better results.

Notes

Legislation may be introduced to limit dividends of public companies to a maximum reached in any one of the three pre-war years. The period, the *Financial News* points out, includes 1937, a very prosperous year for rubber companies when unusually high dividends were declared.

The board of the British Rubber Publicity Association recently elected E. Jago chairman and A. C. Mathews vice chairman for the ensuing year. Mr. Jago, a member of various organizations dealing with colonial trade and publicity, was in the Malayan Civil Service 12 years prior to being appointed deputy agent for the Malayan government in London in 1935, a post he still holds. Mr. Mathews, formerly a planter in Ceylon, has been closely connected with the rubber plantation industry since 1904 and is now a partner in the London firm of tea and rubber company secretaries, Robertson Bois & Co. He has been president of the Ceylon Association for the past two years and a member of the Council of the Rubber Growers' Association since 1934.

War precautions have led to a large demand for the new resilient sponge rubber packing material put out by Vol-Crepe Ltd., Glossop. The material comes in strip form and is available in nine thicknesses ranging from ⅛-inch to one inch, and in seven widths, from ½-inch to three inches. It is used for window and door frames in dugouts, gas-proof shelters, etc. The firm supplies adhesives for attaching the strip to wood and other substances, but it recommends rivets, nails, or bolts for securing the material to metal.

Britain's foreign trade in crude rubber manufactures in the first quarter of 1940 increased considerably compared with results in the corresponding period of 1939. Crude rubber imports were £3,271,000, against £2,096,000; imports of manufactures of rubber, £322,649, against £202,172, but the increase here occurred in the first two months of the year; March figures declined 50%. Exports of rubber manufactures in the first quarter of 1940 were £726,148, against £373,789 in the same period last year.

The Institution of the Rubber Industry, 12 Whitehall, London, S.W.1, according to Secretary W. F. V. Cox, is progressing very satisfactorily in these difficult times, and its meetings have been well attended in all sections. At the eighteenth annual general meeting on May 22, Sir Walrond Sinclair, K.B.E., was reelected president. Mr. Cox, apart from his usual I.R.I. work, is also secretary of the Voluntary Rubber Control Scheme and Rubber Export Group.

NORWAY

After 1929 the Norwegian rubber industry advanced considerably, and before the present hostilities annual crude rubber consumption averaged about 2,000 tons. About 15 large and small factories, employing approximately 2,000 workers, were engaged in manufacturing rubber goods. Local output, however, though steadily growing, could not cover home demands, and in 1938 rubber goods valued at about 4,500,000 kroner were imported: automobile tires, value 1,400,000 kroner; rubber in sheets and tubes, 1,100,000 kroner; hose, 500,000 kroner; cycle tires, 300,000 kroner; cycle tubes, 200,000 kroner; soles and heels, 200,000 kroner; galoshes, 500,000 kroner.

The exports included: belting, value, 900,000 kroner; and galoshes, 800,000 kroner.

PORTUGAL

According to the "Jornal do Comercil e das Colonias," Lisbon, February 26, 1940, Carlos Farinha was authorized to install a factory for making rubber tires and tubes. The government requires detailed plans of the plant and installation to be submitted within six months, and the plant must be ready for operation within 18 months from the date of approval. Other terms of the concession follow: exclusive basis for a decade; capitalization, 15,000,000 escudos ($550,000) of which 75% must be Portuguese; use wherever possible of raw materials of Portuguese origin; during the period of concession no decrease by the government of present duties on imported tires and tubes.

SOVIET RUSSIA

New Rubber Factory

According to news from Moscow, a new rubber factory is to be erected on the Dessna River, near Makoschina, a river port in the Chernigov district of the Ukraine. The factory, to be devoted to the preparation of rubber from *Kok-Saghiz* plants, expects to have at least part of its works to be in operation before the end of 1940.

Synthetic Latex in Brake Linings

It has for some time been customary in Soviet Russia to make brake linings of pressed asbestos fiber impregnated with a solution of linseed oil in white spirits. However, as it was desired to avoid the use of the last two materials for this purpose and also to simplify the manufacturing process, experiments[1] were conducted at the Jaroslawl Asbestos Factory in which a synthetic divinyl latex of type DAB was used as a binder instead of the oil.

The process employed follows. Asbestos fibers were first treated in the Hollander to loosen and separate the individual fibers. Fillers (as zinc oxide, barytes, red iron oxide, china clay, whiting) and sulphur were added in the form of a paste, and then the latex in proportions varying from 15% to 20% by weight of the mix. This was then transferred to a mixing trough and diluted to the desired consistency; next it was passed through a pasteboard making machine, and sheets were produced varying in thickness from 5 to 22 mm. These sheets were then subjected to pressure to remove excess water, cut to the desired shapes and sizes, dried in ovens, passed through a hydraulic press, and finally vulcanized, polished, and tested,

Brake linings thus produced are said to have several advantages over the oil-impregnated linings formerly made. First, the number of operations is cut from 18 to 12, and the time, from 12 days to three or four days. Furthermore, danger from fire and gases is greatly reduced, with consequent improvement of working conditions for labor.

Comparative tests of four types of synthetic latex brake linings, the usual type of oil-impregnated linings, so-called Ferodo linings made in Soviet Russia, and imported braided "Ford" linings showed that under normal conditions latex-treated linings of type 3 were second only to the Ferodo linings in respect of braking efficiency; that they were equal to the imported linings as regards smoothness of braking, showed less wear and tear than the usual linings, and in addition had considerable resistance to water, oil, and changes in temperature.

[1] "Synthetic Latex in Brake Linings." V. D. Gerasimova and E. L. Podocenova, *Kauchuk i Resina*, 1, 63-64 (1940).

Plasticity of Synthetic Rubber

The effect of progressively increased amounts of fillers on the plasticity of synthetic rubber was investigated by N. A. Chesnokov,[1] of the Leningrad Chemical Technological Institute. For this purpose two types of butadiene rubber were used, one having a Williams plasticity of 0.49 and the other of 0.31. The fillers, in powder form, included talcum, whiting, precipitated calcium carbonate, china clay, zinc oxide, lithopone, diatomaceous earth, lamp black, gas black, carbonate of magnesia, magnesium oxide, and they were added in the proportions of 5%, 10%, 20%, 30%, 40%, and 50% by volume of the total mix. Thus five volume parts of filler were used with 95 volume parts of rubber, and so on.

It was established that none of the ingredients investigated increased the plasticity of the synthetic rubber. With most of the ingredients the addition of 30% by volume caused a marked decrease in plasticity of the first type of rubber (the more plastic rubber), but much smaller proportions of gas black and oxide of magnesia were enough to cause a similar decrease in plasticity.

As to the second type of rubber (the less plastic rubber), a marked decrease in plasticity occurred with the incorporation of smaller proportions than 30% in the case of most of the ingredients (lithopone, magnesium oxide, carbonate of magnesia, and lamp and gas blacks.)

Considered with regard to their effect on the plasticity of butadiene rubber, the ingredients may be divided into three groups: those producing small variations in the plasticity of rubber (talcum and whiting); those which greatly decrease plasticity (lamp black, gas black, magnesium oxide, and carbonate of magnesia); and finally those which have a moderate effect on plasticity (the rest of the ingredients.)

[1] "Effect of the Amount of Filler on the Plasticity of Synthetic Rubber." *Kauchuk i Resina*, 11, 11-13 (1939).

GERMANY

The Reich Commissar, Dr. Ernst, has appointed Bernhard Pfotenhauer, of Fa. E. Merck, Darmstadt, administrator of the Deutsche Dunlop Gummi Co. A.G., Hanau a.M. The former directors (except the chairman of the board), G. Feldman, J. Keim, Dr. H. A. Sammet, and Max Brauning, Jr., have been made managers.

Gummi Werke Elbe A.G., Piesteritz bei Klein-Wittenberg (Elbe) reports that despite the outbreak of the war, business increased in 1939 as compared with 1938. War conditions made various changes necessary, including the adaptation of the works to the use of domestic raw materials. This, it is reported, went so smoothly, as a result of careful planning, that it was possible to obtain satisfactory results. The firm was able to maintain exports even in the later months of the year. The company made net profits of 149,317 marks and proposed a 10% dividend.

The New York Hamburger Gummi-Waren Co. also claims to have made satisfactory business progress in 1939. In the first eight months of the year domestic sales increased more than 40%; while exports were maintained at practically the same level as in 1938. The outbreak of the war with its new requirements disrupted business for a short time, but within two months the necessary adjustments had been made, and operations were resumed on a practically unchanged scale. The conversion to the use of domestic raw materials instead of rubber caused no special difficulties as the company had for years been working with them on a limited scale. The concern, which, incidentally, has now acquired the remaining shares of the Deutsche Tornesit G.m.b.H., Hamburg, made net profits of 233,360 marks and paid a dividend of 6%.

The Englebert A.G. Gummiwarenindustrie, Warsaw, closed its accounts for 1939 with a loss of 36,587 zloty.

The Semperit Oesterreichisch-Amerikanische Gummiwerke A.G., Vienna, had net profits of 548,100 marks in 1939 and declared a 5% dividend. The company reported considerable increase in both output and sales as compared with 1938, and in spite of the war, extension of the works could be continued. The agreement concluded with the Continental company of Hannover with regard to technical assistance is working out satisfactorily.

Franz Clouth, Rheinische Gummiwarenfabrik A.G., booked net profits for 1939 of 249,000 marks, including a carry-forward of 24,000 marks. This company has a capital of 2,250,000 marks.

The Wolbrom Gummiwarenfabrik A.G., Wolbrom b. Sosmowitz (formerly Poland) was capitalized at 1,600,000 zloty before the war and produced a variety of rubber goods including belting and toys. The concern is being reorganized, and recently new directors and a control commission were elected to conduct the affairs of the concern under conditions now prevailing.

ITALY

A recently issued government decree permits an increase in the price of Italian rubber manufactures over that prevailing since August 25, 1939. Tires and tubes for motor vehicles and bicycles, rubber hose, rubber summer shoes, women's rubber boots, and rubber thread may be raised 15% in price. An increase in the price of all other rubber goods is only allowed in so far as the higher price of raw materials justifies, but in any case the increase may not exceed 15% of the previous cost price.

FAR EAST

MALAYA

1939 Production Figures

Rubber production on small holdings in Malaya in 1939 came to 116,569 tons, against 114,678 tons in 1938; the increase was almost entirely due to larger outputs in the Unfederated Malay States, which produced 54,850 tons, against 50,442 tons the year before. The totals for the Straits Settlements were 9,950, against 9,906 tons, and of the Federated Malay States, 51,769 against 54,330 tons. The increase for the year might have been larger had not a drop occurred in outputs in the last quarter of 1939 as compared with the same period of 1938, 30,940 against 38,836 tons. This decrease was reported partly due to the shortage of coagulants, a lack of which also hampered efforts of Asiatic rubber instructors and demonstrators to help natives improve the quality of their rubber.

Some districts report a large amount of replanting and new planting, and a growing tendency to use proved clonal material for planting is noted. To meet the demand and also to stimulate interest all around, agricultural stations in certain districts have laid out nurseries where buddings are to be started from which budwood will be supplied to natives at cheap rates. At these stations too, natives are assisted with advice and practical demonstrations of budding. In Negri Sembilan a few budwood nurseries are said to have been established by Malaya, and it seems that fairly extensive preparations for bud-grafting are also being made by the larger Chinese and Indian-owned plantations.

There is increasing interest among small-holders in Johore in the sale of latex, and a Singapore firm is said to have organized the purchase of latex from natives on a relatively large scale.

Drought in Malaya

From the end of November, 1939, into April, 1940, drought conditions prevailed in different parts of Malaya. In some districts the drought was said to be the worst experienced in many years. As a result of the prolonged dry period and to a small extent also of the severe winter, estate outputs have in many cases been considerably below normal.

Effect of Wintering on Bud-Grafts

The planting correspondent of the *Straits Budget*, discussing the slow rate of recovery in crop returns after the past winter season on budded areas, says: "I understand bud-grafted areas in tapping during the wintering season show a much bigger drop in yields proportionately than does ordinary seedling or clonal seedling rubber. No doubt in this respect, however, different clones have their own little peculiarities, some showing much bigger decreases in yield than others."

He goes on to quote a neighboring rubber planter whose yields from Tj.1 fell back to the 1937 level in the wintering period just past and suggests that a problem for consideration now is the length of the rest period that bud-grafted trees, or rather different clones, should be given.

Rubber Planting in Johore

Johore, largest rubber-growing state in Malaya, taking full advantage of the permission for new planting up to 5% of the planted area, during 1939 added more than 50,000 acres to its planted area. The new plantings represent a potential investment value of between $2,000,000 and $2,500,000 (Straits currency), according to the 1939 report of the Deputy Controller of Rubber, for Johore.

The removal of all restriction on replanting proved a strong stimulus, and 11,441 acres of old and poor rubber were replanted during the year with the best planting material that was available.

At the end of 1939 the total area under rubber was estimated at 941,129 acres. The total acreage reported by estates to be tappable at the end of the year was 476,148 acres, of which 372,949 acres were said to be in tapping at the time. The area of budded rubber declared tappable at the end of 1939 was 50,877 acres, of which 32,460 acres were actually being tapped at that time.

NETHERLAND INDIA

Determining D.R.C. in Latex Serum

The usual method of determining the dry rubber content of latex serum is the same as that employed for normal latex: acid is added to coagulate the rubber, and the coagulum is worked to crepe, which is then weighed. But in serum, which has a low rubber content and a relatively high non-rubber content, the addition of acid in the usual manner results in the coagulation of a large amount of protein along with the rubber so that, on the one hand, it is difficult to obtain a coherent piece of crepe, and, on the other, the true D.R.C. figure is not found, but a value that is too high.

Other methods have, therefore, been tried. G. E. van Gils proposed to hydrolize the protein in the serum by heating with alkali before coagulating as usual. Crepe obtained by this method, however, has an abnormally low nitrogen content; hence if sufficiently accurate results for processing control are to be obtained, the method must be applied to the latex and the latex cream as well as to the serum in order to get similar values for nitrogen content in all three cases. But fictitious values, which are not in general use among consumers of latex, would thereby be introduced.

Still another method, consequently, was suggested by W. T. L. Ten Broeck, of the Goodyear Rubber Plantations Co., which was further investigated by O. B. Schreeke at the General Experiment Station of the A.V.R.O.S. The procedure is to add to the serum a certain quantity of cream obtained from the same latex as the serum. The D.R.C. of the mixture is determined, and from the difference between this value and the D.R.C. of the cream the D.R.C. of the serum is calculated.

The method is based on the assumption (which later findings support) that by mixing a definite quantity of cream and serum, a dispersion is obtained which very closely resembles the original latex, and that, therefore, the ratio of rubber to non-rubber particles in the crepe obtained will be normal. Since latex on concentration is frequently divided into approximately equal amounts of cream and serum, it is in practice sufficient to mix equal weights of cream and serum. Thus 25 grams of cream could be weighed off in each of two beakers, and 25 grams of serum added to one. The latex, which may be diluted, is coagulated in the usual manner, and the coagulum milled to crepe. By multiplying by 4 the difference in the weight of the two pieces of crepe obtained, the D.R.C. of the serum is found.

The method appears to be highly suitable for factory control as well as for laboratory work. It has the advantage of being simple—the only extra work involved consists merely in weighing out an additional 25 grams of cream and 25 grams of serum—and of taking into account the protein in the serum.

Exports

Rubber exports from Netherland India in March, 1940, totaled 44,079 tons. Estates in Java and Madoera supplied 9,551 tons, and those in the Outer Provinces, 13,765 tons. Besides 550 tons were shipped from Java and Madoera on B. assignments. (This was estate-type rubber produced on native holdings.) Native rubber shipped from the Outer Provinces came to 20,213 tons.

Editor's Book Table

BOOK REVIEWS

"Practical Latex Work." H. J. Stern. Foreword by R. J. Noble. The Blackfriars Press, Ltd., Leicester, England. 1940. Boards, 4⅞ by 7¼ inches, 103 pages. Available in the United States and Canada from INDIA RUBBER WORLD. Price $1.50.

During 1938 and 1939 a series of articles on latex by the author of this book appeared in *The Rubber Age (London)*. In answer to the interest which these aroused the author has revised the original articles and now presents them in handy book form. As the title implies, the book is concerned with the manufacturing operations involved in latex usage.

The subject is introduced by a discussion of the raw materials: normal, centrifuged, creamed, and evaporated latices. This is followed by two chapters on compounding, which include: compounding ingredients, grinding and dispersing methods and equipment, and preparation of the latex mix. The more important manufacturing operations, dipping, spreading, and coating, are treated in detail, with attention given to the various methods employed in each case. Separate chapters deal with vulcanized latex and cost calculation of latex compounds. Throughout the book the author has injected numerous practical hints and suggestions that may be helpful in solving some of the difficulties encountered in latex processing. To the user of latex this little book can be heartily recommended.

"Suprex Clay." J. M. Huber, Inc., 460 W. 34th St., New York, N. Y. 64 pages. In the introduction of this booklet, prepared by C. A. Carlton, manager of Huber's development department, it is stated, "Despite the fact that clay is one of the most widely used compounding ingredients in the rubber industry, it has not been the subject of as much comprehensive investigation as other materials some of which enter more definitely into the vulcanization reaction."

The present work is aimed at providing the compounder with a comprehensive summary of the characteristics of clays as related to rubber compounding. It contains much tabular and graphical information and is copiously illustrated with photographs of production and testing operations.

The contents are divided into three parts: Part I covers definitions, origin, occurrence, chemical composition, production methods, and uses in rubber with a distinction made between the hard reenforcing clays and the softer clays which are used as cheap fillers; Part II is concerned with the physical characteristics of clay and the tests involved; Part III, which is the largest section, presents a wide variety of data for the evaluation of clay in rubber. It is a study of this section which should reveal whether or not clay can be used to solve a particular compounding problem. The book is well bound, the format excellent, and the contents definitely informative.

"Annual Report on the Progress of Rubber Technology." Vol. III. 1939. Published by The Institution of the Rubber Industry, 12 Whitehall, London, S.W.1, England. Paper, 7¼ by 9¾ inches, 167 pages. Subject and author indexes. Price: to non-members of I.R.I., 10s. 6d.: to members 2s. 6d.

Volume III of this annual review summarizes progress during 1939 in the principal branches of rubber technology and manufacture. The 24 chapters of the present work cover essentially the same ground as did Volume II; while the same authors of separate chapters have been retained in only nine instances. The scope of the work is broad and includes: planting, properties of raw and vulcanized rubber, latex, synthetic rubber, test equipment, compounding ingredients, fibers and textiles for rubber, machinery, sponge and hard rubber, and the technology involved in the manufacture of tires, belting, hose, cables, footwear, mechanical goods, roads, flooring, etc. Each phase of the work has been competently dealt with by an authoritative worker in that field. Total references to the literature and patents which appear at the end of the respective chapters number 1,195.

"Commodities in Industry. (The 1940 Commodity Year Book.)" Prepared and published by Commodity Research Bureau, Inc., 82 Beaver St., New York, N. Y. Cloth, 8½ by 11 inches, 720 pages. Indexed. Price $7.50.

In this book 75 basic commodities including rubber are analyzed individually, with a separate section for each commodity containing a description of processing methods, a review of 1939 activities, and the vital statistics and prices in chart and tabular form. Altogether more than 150 charts and 625 statistical tables appear. The effect of war on commodity prices is analyzed in one chapter. In this study are pointed out many striking similarities between price movements duing the present war and the early stages of the World War which started in 1914. Other subjects analyzed include the challenge of synthetics and plastics to the use of basic commodities in industry. The conclusion is reached that, although synthetics are making rapid progress, only in rare cases such as rayon versus silk have they made any appreciable progress against basic commodities. The development of synthetic rubber is discussed briefly in this respect.

"Printing Inks. Their Chemistry and Technology." Carleton Ellis. Published by Reinhold Publishing Corp., 330 W. 42nd St., New York, N. Y. Cloth, 6 by 9 inches, 560 pages. Glossary. Name and subject indexes. Price $7.

A lack of an up-to-date comprehensive treatise on the subject of printing inks led to the preparation of this book, designed to aid the chemist as well as the printer. Recognition is made of the recent trend toward the production of inks containing synthetic resins, and the text includes the various applications of these materials. Numerous references throughout the book are concerned with the use of rubber, rubber derivatives, and latex in printing inks; while one section deals with inks for printing on rubber. A glossary has been added covering such terms frequently used throughout the text as might require explanation for those unfamiliar with the subject.

NEW PUBLICATIONS

"Tumblemixers and Ball Mills." The U. S. Stoneware Co., 60 E. 42nd St., New York, N. Y. This new catalog page describes the firm's improved line of Tumblemixers for mixing or blending powders and solutions and for acid washing of golf balls, syringes, small rubber parts, etc. The page also includes data and specifications on the company's ball mills and on grinding media for these mills.

"Catalog of Rubber and Composition Machinery—1940." Stewart Bolling & Co., 3190 E. 65th St., Cleveland, O. 52 pages. This catalog illustrates and describes machinery for rubber, plastics, compositions, paints, and synthetics. The rubber equipment includes experimental and production mills and calenders, vulcanizers and presses, and cutting equipment. Also featured are rebuilt machines for the same industries. Special machines and parts are likewise included. The firm also has a rebuilding and modernizing service.

"Is Industrial Unemployment Actually Technological?" No. 36 in a Series of Booklet-Editorials by Allen W. Rucker in collaboration with N. W. Pickering, President, Farrel-Birmingham Co., Inc., Ansonia, Conn. 20 pages. That the loss of job opportunity in our most important industrial areas is not due to increased mechanization, but to the heavy shrinkage in the number of operating plants is the conclusion reached by the authors of this study. The study embraces the total employment opportunity, payrolls, and average annual incomes per worker in 18 major industrial areas for 1929 and 1937.

"Bristol's Recording Voltmeters and Ammeters." Bulletin 543. The Bristol Co., Waterbury, Conn. The firm's round-chart recording voltmeters and ammeters are described, together with some of their more common applications. Illustrations show the various models available for wall and flush panel mounting and for portable use. Drilling dimensions and a list of chart ranges are included.

"Bakelite Materials for Rubber Plate Printing." Bakelite Corp., Bloomfield, N. J. 12 pages. The use of Bakelite matrix materials for making rubber printing plates is discussed in this booklet. The matrix sheet is described as a specially processed fibrous board in which a phenolic resinoid has been incorporated. The two essential steps in rubber plate making are outlined, producing the matrix from the original type form or pattern plate and molding the rubber plate. Seven advantages of rubber plate printing are pointed out.

Rhode Island Club

(*Continued from page* 61)

A. Davis (Goodyear Footwear) tied with S. J. Lake (Respro) and J. Marshall (Collyer Insulated Wire); *consolation prize*, J. Murray (Anaconda Zinc).

Prize donors were: Akron Standard Mold Co.; J. H. Best Co.; Brockton Cutting Die & Machine Co.; Callaway Mills, Inc.; Cannon Mills, Inc.; Carpenter-Morton Co.; Curran & Barry; E. I. du Pont de Nemours & Co., Inc.; General Atlas Carbon Co.; Gair Cartons, Inc.; Howe & French, Inc.; Ernest Jacoby & Co.; J. & H. Electric Co.; J. D. Lewis; Johns-Manville; H. Muehlstein & Co., Inc.; Pequanoc Rubber Co.; Respro, Inc.; Rohm & Haas Co.; A. Schulman, Inc.; Shaw Motors; Shoe Hardwear; Southeastern Clay Co.; Stamford Rubber & Supply Co.; Titanium Pigment Corp.; Union Equipment & Supply; U. S. Rubber Reclaiming Co., Inc.; Vansul, Inc.; L. G. Whittemore, Inc.; Wishnick-Tumpeer, Inc.; and Woodward Baldwin & Co.

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World Net Imports of Crude Rubber—Long Tons

Year	U.S.A.	U.K.†	Argentine	Australia	Belgium	Canada	France	Greater Germany‡	Italy	Japan	Poland	Sweden	U.S.S.R.	Rest of World	Total
1938...	406,300	168,172	7,700	12,300	11,300	25,700	58,100	107,900	28,200	46,300	7,900	8,300	26,800	49,200	928,000
1939...	486,348	....	9,552	15,315*	9,593	32,508	....	....	....	42,351	....	....	....	60,811	....
1939															
Jan. ..	36,614	7,121	417	954	898	2,867	4,694	9,095	2,133	2,553	665	643	4,000*	4,282	70,651
Feb. ..	30,578	8,087	1,092	1,785	1,068	1,451	5,327	8,348	2,025	3,263	709	467	1,000*	4,824	66,710
Mar. ..	45,286	12,092	440	1,324	1,242	2,458	4,503	9,028	1,525	4,019	985	581	2,000*	4,901	86,374
Apr. ..	31,590	7,129	786	1,138	855	1,559	5,650	9,316	1,926	3,579	673	994	2,000*	4,614	69,432
May ..	45,390	10,488	353	1,202	792	3,069	4,646	9,031	1,573	4,438	940	1,047	1,000*	5,818	86,830
June ..	33,950	10,287	965	1,348	621	2,465	4,649	8,677	1,992	3,067	693	2,252	500*	4,800	74,295
July ..	36,932	6,205	983	1,472	836	3,214	4,282	8,849	1,408	3,668	750*	644	1,000*	4,541	72,520
Aug. ..	38,319	9,391	619	2,182	952	2,187	....	....	....	3,146	....	1,057	2,500*	5,286	77,030
Sept. ..	36,197	....	965	875	108	2,639	....	....	....	2,801	....	280	....	4,819	....
Oct. ..	39,735	....	562	1,335	519	5,787	....	....	....	2,749	....	....	....	4,604	....
Nov. ..	41,478	....	359	900*	667	1,709	....	....	....	5,106	....	....	....	5,471	....
Dec. ..	70,279	....	2,011	800*	1,054	3,103	....	....	....	3,962	....	....	....	6,851	....
1940															
Jan. ..	71,541	....	1,049	1,000*	891	5,047	....	....	....	4,547	....	....	....	....	....
Feb. ..	41,797	....	565	1,800*	694	3,508	....	....	....	5,243	....	....	....	....	....
Mar. ..	58,283	....	756	....	....	3,062	....	....	....	....	....	....	....	....	....

* Estimated. †U. K. figures show gross imports, not net imports. ‡Including imports of Austria and Czechoslovakia. Source: *Statistical Bulletin of the International Rubber Regulation Committee.*

Patents and Trade Marks

MACHINERY

United States

2,199,550. **Apparatus and Process to Rewind Elastic Filaments.** F. J. Tobias, assignor to Filatex Corp., both of Trenton, N. J.

2,199,790. **Apparatus and Method to Make Bathing Caps.** R. H. Guinzberg, Flushing, assignor to I. B. Kleinert Rubber Co., New York, both in N. Y.

2,199,882. **Apparatus and Process to Spin Rubber Thread** from Rubber Latex Utilizing Two Types of Coagulating Liquids. T. Inokuchi, Toshima-Ku, Tokyo, and U. Kawarahata, Kawagoye, assignors to Toyo Gomu Kagakukogyo Kabushiki Kaisha, Tokyo, all in Japan.

2,200,730. **Rotary Cutter.** H. M. Smallwood, New York, N. Y., and H. T. Battin, Ridgewood, N. J., assignors, by mesne assignments, to United States Rubber Co., New York, N. Y.

2,200,735. **Continuous Vulcanizing Apparatus.** H. T. Battin, Ridgewood, N. J., assignor, by mesne assignments, to United States Rubber Co., New York, N. Y.

2,200,871. **Tire Vulcanizer.** G. P. Bosomworth, assignor to Firestone Tire & Rubber Co., both of Akron, O.

2,200,875. **Mixer Mill** for Plastic Material. T. W. Edwards and C. H. Nagel, assignors to Firestone Tire & Rubber Co., all in Akron, O.

2,200,886. **Grid Trimmer.** M. O. Kuhn, Cuyahoga Falls, O., assignor, by mesne assignments, to Firestone Tire & Rubber Co., Akron, both in O.

2,200,997. **Extruder.** V. E. Royle, Paterson, N. J.

2,200,998. **Hydraulic Press.** C. F. Schnuck, New Haven, assignor to Farrel-Birmingham Co., Inc., Ansonia, both in Conn.

2,201,443. **Auxiliary Hydraulic Device** for Platen Presses. H. F. MacMillin, Mt. Gilead, O., assignor to Hydraulic Press Corp., Inc., Wilmington, Del.

2,201,470. **Tire Tread Splice Stitcher.** H. C. Bostwick, Coventry Township, assignor to Akron Standard Mold Co., Akron, both in O.

2,201,516. **Adhesive Applicator.** J. R. Bedell, Cuyahoga Falls, O., assignor to B. F. Goodrich Co., New York, N. Y.

2,202,750. **Means to Manufacture Rubber Soled Footwear.** L. A. Andia, Boston, Mass., assignor to Compania Industrial Del Caucho, Sociedad Anónyma Comercial é Industrial, Buenos Aires, Argentina.

2,202,797. **Apparatus and Method to Cure and Mold Synthetic or Natural Resins.** J. R. Hoge and L. D. Soubier, both of Toledo, O., assignors to Owens-Illinois Glass Co., a corporation of O.

Dominion of Canada

388,584. **Tire Vulcanizer** with Aid for Removing Tire. Wingfoot Corp., Wilmington, Del., assignee of J. H. Zimmerman, Akron, O., both in U. S. A.

388,646. **Press Platen.** Barrett Co., New York, assignee of L. T. Sutherland, Yonkers, both in N. Y., U. S. A.

389,052. **Cemented Pile Fabric Manufacturing Apparatus.** R. S. Allen, Detroit, Mich., assignee of P. S. Smith, New York, N. Y., both in U. S. A.

United Kingdom

516,572. **Sheet Material Splitter.** Sussex Rubber Co., Ltd., and S. Bailey.

517,040. **Machines for Shaping Tubes or Tube Sections.** H. J. Grose, (Tube Turns, Inc.)

517,171. **Apparatus to Repair Fire and Like Hose.** J. Kewley.

PROCESS

United States

2,199,449. **Knitted Fabrics.** P. Schönfeld, Chemnitz, Germany.

2,199,811. **Top Lift Slab** from Vulcanized Fiber Board. W. Wood, Jr., Vancouver, Canada.

2,200,262. **Continuously Molding and Vulcanizing Sheet Rubber** from a Plurality of Strips of Unvulcanized Rubber. F. M. Daley, Shelton, and L. H. De Wyk, Ansonia, assignors to Sponge Rubber Products Co., Shelton, Conn.

2,200,363. **Making a Printing Plate** by Vulcanizing a Thin Layer of Metal Powder-Rubber Mix to a Sheet of Rubber. J. D. Kreis, assignor to Bonnar-Vawter Fanform Co., Inc., both of Cleveland, O.

2,200,847. **Vulcanizing Sponge Rubber.** (Latex.) E. W. Madge, Wylde Green, and A. A. Round and T. Norcross, both of Erdington, Birmingham, assignors to Dunlop Rubber Co., Ltd., London, all in England.

2,200,850. **Flameproofing Sponge Rubber** by a Deposit of Inorganic Fireproofing Material and Chlorinated Diphenyl. C. O. Miserentino, assignor to Dunlop Tire & Rubber Corp., both of Buffalo, N. Y.

2,201,457. **Moistureproof Sausage Casing.** J. P. Smith and W. F. Henderson, assignors to Visking Corp., all of Chicago, Ill.

2,201,576. **Gaskets.** P. W. Dempsey, Pittsburgh, assignor to Westinghouse Air Brake Co., Wilmerding, both in Pa.

2,201,668. **Tire Treads.** H. T. Kraft, Akron, assignor to General Tire & Rubber Co., Summit, both in O.

2,201,669. **Edge Sealing for Sponge Rubber.** H. T. Kraft, assignor to General Tire & Rubber Co., both of Akron, O.

2,201,691. **Golf Ball Cores.** J. R. Gammeter, Akron, O.

Dominion of Canada

388,516. **Laminated Tobacco Pouch.** Canadian Industries, Ltd., Montreal, P. Q., assignee of W. H. Shaw, Mimico, Ont.

388,537. **Laminated Tobacco Pouch.** E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., assignee of A. Hershberger, Buffalo, N. Y., both in U. S. A.

388,538. **Laminated Tobacco Pouch.** E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., assignee of J. W. Rash, Fairfield, Conn., both in U. S. A.

388,582. **Transmission Belt.** Wingfoot Corp., Wilmington, Del., assignee of A. M. Finley, Tallmadge, O., both in U. S. A.

United Kingdom

516,365. **Fabrics Coated with Rubber or Other Like Resin, Natural or Artificial.** Veedip, Ltd., and S. D. Sutton.

516,447. **Coatings of Highly Polymerized Artificial Materials** on Wires, Threads, Etc. Siemens-Schuckertwerke Akt.-Ges.

516,573. **Molding and Finishing Articles of Rubber or Rubber Compositions.** Sussex Rubber Co., Ltd., and S. Bailey.

516,638. **Tennis and Other Game Balls.** Dunlop Rubber Co., Ltd., and S. G. Ball.

516,811. **Yarns and Threads** for Use as Tire Cords. P. E. Harrison.

517,111. **Constructing and Fitting Detachable Strakes** for Pneumatic Tired Wheels. J. O. Youngman.

517,266. **Game Balls.** A. G. Spalding & Bros. (British), Ltd.

517,302. **Synthetic Rubber.** Istituto per lo Studio della Gomma Sintetica.

CHEMICAL

United States

2,199,979. **Vulcanizing Rubber** in the Presence of Sulphur, an Accelerator and a Dicyclohexyl Compound. D. J. Beaver, Nitro, W. Va., assignor to Monsanto Chemical Co., St. Louis, Mo.

2,200,473. **Blowing Agent** for Rubber. A. F. Hardman, Akron, O., assignor to Wingfoot Corp., Wilmington, Del.

2,200,525. **Antioxidant**—A Secondary N-Furfuryl N-Aryl Amine. C. F. Winans, Akron, O., assignor to Wingfoot Corp., Wilmington, Del.

2,200,526. **Antioxidants**—N-Methylene Arylene Diamine Omega Sulphonic Acids and N-Methylol Arylene Diamines. W. D. Wolfe, Cuyahoga Falls, O., assignor to Wingfoot Corp., Wilmington, Del.

2,200,705. **Rubber-like Interpolymerization Products** of Butadiene and a Vinyl Ethinyl Carbinol. (Synthetic.) W. Sandhaas, Mannheim, W. Daniel, Ludwigshafen a.R., and K. Mühlhausen, Leverkusen, assignors to I. G. Farbenindustrie A. G., Frankfurt, a.M., all in Germany.

2,200,715. **Isomerizing Rubber** by Heating with Phenol and an Inorganic Acid. A. Greth and J. Reese, both of Wiesbaden, Germany, assignors to Resinous Products & Chemical Co., Philadelphia, Pa.

2,200,747. **Antioxidant**—Reaction Product Containing a Major Proportion of Alkylated Secondary Aromatic Amine Material. L. H. Howland, Nutley, N. J., assignor, by mesne assignments, to United States Rubber Co., New York, N. Y.

2,200,756. **Antioxidant**—A Polymeric C-Alkenyl Substituted Diarylamine. W. E. Messer, Cheshire, and H. H. Bassford, Jr., Naugatuck, both in Conn., assignors, by mesne assignments, to United States Rubber Co., New York, N. Y.

2,201,034. **Composition Comprising a Rubber Hydrohalide and One of the Following:** Chlorinated Diphenyl, Chlorinated Diphenyl Ethers, and Chlorinated Naphthalene. E. Gebauer-Fuelnegg, deceased, late of Evanston, by M. Gebauer-Fuelnegg, administratrix, Evanston, and E. W. Moffett, Chicago, assignors to Marbon Corp., Chicago, all in Ill.

2,201,259. **Fractionation of Chlorinated Ketones** by Steam Distillation. A. E. Calkins, Akron, O., assignor to B. F. Goodrich Co., New York, N. Y.

2,201,271. **Mold Lubricant** Comprising a Film of Cellulose Ether. E. G. Partridge, Stow, O., assignor to B. F. Goodrich Co., New York, N. Y.

2,201,273. **Dispersing Pigment in Rubber** in the Presence of Heat-Liquefied Oxygenated Rubber. F. K. Schoenfeld, Silver Lake, O., assignor to B. F. Goodrich Co., New York, N. Y.

2,201,537. **Liner** for Separating Adhesive Material. W. R. Hickler, Weston, assignor to Hood Rubber Co., Inc., Watertown, both in Mass.

2,201,992. **Tire Cords** Comprising Cellulosic Yarns Treated with Tricresyl Phosphate. C. Dreyfus, New York, N. Y., and G. Schneider, Montclair, N. J., assignors to Celanese Corp. of America, a corporation of Del.

2,202,092. **Finishing Leather** by Immersion in Hot Bath of Vulcanizable Rubber Composition and Paraffin. L. B. Contant, Boston, Mass.

2,202,363. **Plasticized Synthetic Rubber Composition** of High Stability Comprising a Diolefin Hydrocarbon Polymer Rubber and a Linear-Type Plastic Aliphatic Iso-Mono-Olefin Hydrocarbon Polymer. P. J. Wiezevich, now by judicial change of name P. J. Gaylor, Elizabeth, N. J., assignor to Standard Oil Development Co., a corporation of Del.

Dominion of Canada

388,530. **Antioxidant**—Secondary Aromatic Amino Compound Comprising at Least Three Aromatic Rings at Least One of Which Is a Benzene Ring. Dominion Rubber Co., Ltd., Montreal, P. Q., assignee of W. E. Messer, Cheshire, Conn., U. S. A.

388,531. **Antioxidant**—Polymeric C-Alkenyl Substituted Secondary Arylamine. Dominion Rubber Co., Ltd., Montreal, P. Q., assignee of W. E. Messer, Cheshire, and H. H. Bassford, Jr., Naugatuck, co-inventors, both in Conn., U. S. A.

388,532. **Antioxidant**—Comprising a Perimidine Compound. Dominion Rubber Co., Ltd., Montreal, P. Q., assignee of W. E. Messer, Cheshire, Conn., U. S. A.

388,534. **Polymerization of Chloro-2-Butadiene-1,3** in the Presence of Hydrogen Sulphide. ((Synthetic.) E. I. du Pont de Nemours & Co., Inc., assignee of H. W. Starkweather and A. M. Collins, co-inventors, all of Wilmington, Del., U. S. A.

388,535. **Polymerization of Butadiene.** (Synthetic.) E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., assignee of N. D. Scott, Sanborn, N. Y., both in U. S. A.

388,573. **Rubber-like Products** Obtained by Treating Polymerized Isobutylene, Having a Molecular Weight between 1,000 and 40,000, with Sulphur Monochloride. (Synthetic.) Standard Oil Development Co., Linden, assignee of R. M. Thomas, Union, both in N. J., U. S. A.

388,583. **Urea Derivative Preparation.** Wingfoot Corp., Wilmington, Del., assignee of W. Scott, Akron, O., both in U. S. A.

388,585. **Vulcanizing Rubber** in the Presence of the Reaction Product of a Haloimide of a Dibasic Acid and a Dithio Acid. Wingfoot Corp., Wilmington, Del., assignee of G. W. Watt, Austin, Tex., both in U. S. A.

388,586. **Vulcanizing Rubber** in the Presence of a Thiazole-Type Accelerator and a Guanidine Salt of a Dithiocarbamic Acid Derived from a Primary Amine. Wingfoot Corp., Wilmington, Del., assignee of G. W. Watt, Austin, Tex., both in U. S. A.

388,587. **Accelerator**—Compound Having the Formula $>N\text{-}CSS\text{-}CO\text{-}X$ in Which R and R_1 Are Alkyl, Aryl, or Aralkyl Groups and X Is an Aromatic Group. Wingfoot Corp., Wilmington, Del., assignee of G. W. Watt, Austin, Tex., both in U. S. A.

388,600. **Heat- and Light-Resistant Vinyl Polymers.** (Synthetic.) Carbide & Carbon Chemicals, Ltd., Toronto, Ont., assignee of M. C. Reed and F. Groff, co-inventors, both of Lakewood, O., U. S. A.

388,649. **Liquid Adhesive Composition** Comprising Malodorant-Free Polymerized Chloroprene and Compounding Ingredients. (Synthetic.) Boston Blacking Co. of Canada, Ltd., Montreal, P. Q., assignee of A. D. Macdonald, Malden, Mass., U. S. A.

388,667. **Antioxidant**—Having an Arylene Group between and Bonded Singly to Each of Two Amino Groups. Dominion Rubber Co., Ltd., Montreal, P. Q., assignee of L. H. Howland, Nutley, N. J., U. S. A.

388,668. **Antioxidant**—A Carbamyl-Amino-Diarylamine. Dominion Rubber Co., Ltd., Montreal,

P. Q., assignee of L. H. Howland, Nutley, N. J., U. S. A.

388,669. **Antioxidant**—Carboxy - Alkyl - Amino - Aryl-Arylamine. Dominion Rubber Co., Ltd., Montreal, P. Q., assignee of L. H. Howland, Nutley, N. J., U. S. A.

388,670. **Antioxidant**—An N-Carbalkoxy-Para-Amino-Diarylamine. Dominion Rubber Co., Ltd., Montreal, P. Q., assignee of L. H. Howland, Nutley, N. J., U. S. A.

389,010. **Accelerator**—Compound with Formula R-S-NH-R1 Where R is an Arylene Thiazyl Group and R1 Is a Cyclohexyl, Benzyl, or Hexahydro-benzyl Radical. Monsanto Chemical Co., St. Louis, Mo., assignee of M. W. Harman, Nitro, W. Va., both in U. S. A.

389,011. **Accelerator**—Compound with Formula R-S-NH-R1 Where R Is an Arylene Thiazyl Group and R1 Is a Hydrocarbon Radical. Monsanto Chemical Co., St. Louis, Mo., assignee of M. W. Harman, Nitro, W. Va., both in U. S. A.

United Kingdom

516,776. **Synthetic Rubber-like Materials.** B. J. Habgood, R. Hill, E. Isaacs, L. B. Morgan, and Imperial Chemical Industries, Ltd.

517,125. **Stabilization of Plastic Polymers of Halogenobutadienes.** (Synthetic.) E. I. du Pont de Nemours & Co., Inc.

GENERAL

United States

2,198,687. **Flexible Frame** of a Collapsible Boat. G. Werner, Peking, China, assignor to G. Von Hessert, New York, N. Y.

2,198,692. **Flap-applying Machine Support.** H. J. Willmott, Beverly, Mass., assignor to United Shoe Machinery Corp., Flemington, N. J.

2,198,698. **Bottle Wiper.** W. M. Fitzmeyer, Omaha, Neb.

2,198,721. **Vehicle Wheel.** H. J. Horn, assignor to Motor Wheel Corp., both of Lansing, Mich.

2,198,724. **Sponge Rubber and Hair Upholstery Padding.** N. P. Schreiner, Springfield, Mo.

2,198,756. **Fountain Pen Holder.** G. K. Bodó, Budapest, Hungary.

2,198,764. **Hammer.** B. E. Edwards, Waynesboro, Tenn.

2,198,780. **Pitman Arm.** E. S. MacPherson, assignor to General Motors Corp., both of Detroit, Mich.

2,198,804. **Inflatable Obstetrical Couch.** F. H. Carlsson, Westmanna Isles, Iceland, assignor of one-half to B. Johannson, Portland, Oreg.

2,198,838. **Refrigerator Door Structure.** F. D. Peltier, Indianapolis, Ind., assignor, by mesne assignments, to Philco Refrigerator Co., Philadelphia, Pa.

2,198,842. **Device to Mount Engine** or Like Apparatus on Its Support. E. P. Renaux, Paris, and L. J. Renaux, Livry-Gargan, both in France.

2,198,854. **Gas Main Stopper.** G. A. Behringer, Brooklyn, N. Y.

2,198,860. **Pneumatic Action** for Typewriters and Other Multiple Key Devices. G. W. Carlson, assignor to R. H. McClintic, both of Pittsburgh, Pa.

2,198,872. **Vibrator and Massager.** C. E. Hegstrom, Chicago, Ill.

2,198,880. **Soap Tablet** Covered with a Soft Sheath. C. Meyer, Paris, France.

2,198,883. **Vehicle Wheel.** J. W. Pattison, assignor to Kelsey-Hayes Wheel Co., both of Detroit, Mich.

2,198,906. **Anti-skid Device.** G. Conway, Bellevue, Pa.

2,198,968 **Golf Teeing Device.** J. F. Jewett, Los Angeles, assignor of two-thirds to D. J. Young, North Hollywood, and R. C. Stevens, West Los Angeles, jointly, all in Calif.

2,198,978. **Rim.** C. H. Sauer, Chico, assignor of one-half to T. R. Rooney, Atherton, both in Calif.

2,198,996. **Hose Coupling.** S. Guarnaschelli, Elmhurst, assignor to Packless Metal Products Corp., New York, both in N. Y.

2,199,004. **Cushion Support.** H. C. Lord, Erie, Pa.

2,199,025. **Means and Method of Closing Surgical Incisions.** C. E. Conn, Los Angeles, Calif.

2,199,032. **Tire Alarm.** W. L. Stoddard, Elgin, assignor of one-half to A. H. Harkey, Fairbank, both in Ariz.

2,199,044. **Fly Swatter.** J. Creary, De Funiak Springs, Fla.

2,199,047. **Pneumatic Cushion.** N. Fisher, Eagle Grove, Iowa.

2,199,054. **Valve Core and Rubber Stem.** M. A. Sorokin, Milford, assignor to Jenkins Bros., Bridgeport, both in Conn.

2,199,079. **Wringer Rolls.** R. I. Miner, assignor to Mullins Mfg. Corp., both of Salem, O.

2,199,084. **Anti-Vibration Suspension** for Vehicles. G. H. Schieferstein, Berlin-Charlottenburg, Germany.

2,199,126. **Fountain Pen.** F. Buschi, assignor to Unique Fountain Pen Corp., both of New York, N. Y.

2,199,143. **Hose Coupling.** H. Stholberg, Virginia, Minn.

2,199,147. **Mop** Having Squeegee Cleaning Device. J. D. Bates, West Springfield, Mass.

2,199,154. **Paint Brush Attachment.** G. Frohnert, Washington, D. C.

2,199,160. **Sealing Mechanism** for Slidable Doors. D. C. E. Leonard, assignor to Jamison Cold Storage Door Co., both of Hagerstown, Md.

2,199,162. **Tire Dislodging Device.** E. W. Oliva, Granger, Tex.

2,199,328. **Apparatus for Coating Paper.** N. Obenshain and W. M. Welton, both of Piedmont, W. Va., assignors to West Virginia Pulp & Paper Co., New York, N. Y.

2,199,229. **Storage Battery.** E. W. Smith, assignor to Electric Storage Battery Co., both of Philadelphia, Pa.

2,199,250. **Elastic Fluid Turbine Packing Arrangement.** G. W. Stroebel, Schenectady, N. Y., assignor to General Electric Co., a corporation of N. Y.

2,199,282. **Comb.** B. and J. M. Condron, both of Pittsfield, Mass.

2,199,287. **Resilient Car Wheel.** T. N. Fritzsch, Johnstown, Pa.

2,199,293. **Fountain Pen.** S. L. Ruskin, New York, N. Y.

2,199,358. **Safety Device for Wringers.** W. O. Duke, assignor to Mullins Mfg. Corp., both of Salem, O.

2,199,408. **Blood Pressure Measurer.** E. J. La Liberte, Worcester, Mass.

2,199,440. **Welding Rod** with Coating Containing Rubber Derivative. A. R. Lytle and T. H. Vaughn, both of Niagara Falls, N. Y., assignors to Oxweld Acetylene Co., a corporation of W. Va.

2,199,442. **Foundation Garment.** H. Mayonnade and C. W. Hine, assignors to I. Newman & Sons, Inc., all of New Haven, Conn.

2,199,466. **Pneumatic Tire** with Circular Sidewall Strips. C. H. McRaven, Houston, Tex.

2,199,473. **Knitted Cap** with Elastic Tape. F. J. Wengen, assignor to Eagle Knitting Mills, Inc., both of Milwaukee, Wis.

2,199,569. **V-Belt Drive.** R. V. Morse, Ithaca, N. Y.

2,199,588. **Hose Coupling** to Aid in Refueling Aircraft in the Air. A. J. Cobham, H. C. Johnson, and P. R. Allison, all of Ford Aerodrome, Yapton, assignors to Flight Refuelling, Ltd., Temple, London, both in England.

2,199,624. **Flexible Coupling** with Annular Fluid Container. T. L. Fawick, Akron, O.

2,199,700. **Rubber Coated Plywood** for Road Surfacing. C. U. Gramelspacher, Jasper, Ind.

2,199,725. **Self-Lubricating Stuffing Box** for Oil Wells. G. R. Huff, Sasakwa, Okla.

2,199,761. **Shaft Seal.** F. Shenton, assignor to Frick Co., both of Waynesboro, Pa.

2,199,816. **Preservation of Biologically Active Substances.** E. W. Flosdorf, Ardmore, assignor to The Trustees of the University of Pennsylvania, Philadelphia, both in Pa.

2,199,844. **Douche Appliance.** L. B. Tucker, Rye, N. Y.

2,199,845. **Receptacles from Discarded Tires.** F. Wolf, High Ridge, Mo.

2,199,860. **Weather Strip Device.** J. C. and J. F. Rogers, both of Rocky River, O.

2,199,888. **Wheel Disk and Wheel Assembly.** G. A. Lyon, Allenhurst, N. J.

2,199,896. **Vehicle Wheel Spring.** O. Siebler and W. Boxan, both of Zschopau, assignors to Auto Union Akt., Chemnitz, both in Germany.

2,199,913. **Garment Fastener.** E. F. Gaines, Bala, Pa.; J. S. Gaines, administratrix of E. F. Gaines.

2,199,926. **Resilient Universal Joint.** B. A. Swennes, Rockford, assignor to Borg-Warner Corp., Chicago, both in Ill.

2,199,935. **Tubular Belt Conveyer.** H. S. Johns, Cleveland, O., assignor to Bancroft Holdings, Ltd., Hamilton, Ont., Canada.

2,199,964. **Stopper.** A. F. Rook, Springfield, N. Y.

2,200,069. **Printing Inks** for Use with Rubber Printing Rolls. H. A. Lubs and C. K. Black, assignors to E. I. du Pont de Nemours & Co., Inc., all of Wilmington, Del.

2,200,081. **Closure Cap** for Glass Containers. J. C. Gibbs, Brooklyn, assignor to Anchor Cap & Closure Corp., Long Island City, both in N. Y.

2,200,091. **Valve** for Water Faucet. C. Kovach, Perth Amboy, N. J.

2,200,133. **Straightening Out Deformed Automobile Bodies, Etc.** S. Mandl, assignor to Blackhawk Mfg. Co., both of Milwaukee, Wis.

2,200,151. **Shaft Seal.** O. M. Burkhardt, assignor to Thompson Products, Inc., both of Cleveland, O.

2,200,176. **Squeeze Roll Assembly.** G. R. Keltie, assignor to American Wringer Co., both of Woonsocket, R. I.

2,200,200. **Container Hermetically Sealed.** J. C. Donnelly, New York, N. Y.

2,200,205. **Vehicle Wheel Structure.** G. A. Lyon, Allenhurst, N. J.

2,200,212. **Gasket.** H. Bohmer, Jr., Riverton, and S. S. Lippincott, Palmyra, assignors to "Flexitallic" Gasket Co., Camden, all in N. J.

2,200,247. **Back Rest for Bathtub.** A. M. Haas, Chicago, Ill.

2,200,257. **Golf Ball** with Defined Internal Tension. B. Bogoslowsky, New York, N. Y.

2,200,305. **Hydrostatic Brake.** C. Sauzedde, assignor to Detroit Hydraulic Brake Corp., both of Detroit, Mich.

2,200,333. **Footwear.** E. Q. Herzog and C. J. Futter, assignors to Mishawaka Rubber & Woolen Mfg. Co., all of Mishawaka, Ind.

2,200,356. **Loom Temple Roll.** (Synthetic.) C. T. Dickey, Elizabeth, N. J.

2,200,361. **Wheel.** J. H. Lunt, assignor to Motor Wheel Corp., both of Lansing, Mich.

2,200,395. **Hot Water Bottle.** F. Lobl, Middleboro, Mass.

2,200,413. **Rotary Shaft Seal.** R. W. Christman, Pontiac, and W. J. McCortney, Royal Oak, assignor to Chrysler Corp., Detroit, all in Mich.

2,200,567. **Door Check.** P. H. Travis, Detroit, Mich.

2,200,600. **Bottle Closures.** G. L. Grapp, Seattle, Wash.

2,200,624. **Hair Clip and Curler.** F. M. Jones, Burlington, Iowa.

2,200,648. **Fountain Pen.** M. J. Waldinger, Flushing, N. Y.

2,200,766. **Tire and Wheel Assembly.** W. O. Bechman and R. A. Holmberg, both of Chicago, Ill., assignors to International Harvester Corp., a corporation of N. J.

2,200,776. **Flat Cable Construction.** V. A. Hoover, Los Angeles, assignor to Byron Jackson Co., Huntington Park, both in Calif.

2,200,785. **Valve Stem.** F. H. Watson, Jonesboro, Ark., assignor, by mesne assignments, to Jenkins Bros., Bridgeport, Conn.

2,200,829. **Fluid Pressure Brake Control Apparatus** for Aircraft. G. E. Beharrell, Streetly, J. Wright, Stoke Park, and H. Trevaskis, Sutton Coldfield, assignors to Dunlop Rubber Co., Ltd., London, all in England.

2,200,830. **Control Valve** for Hydraulic Systems and Apparatus. G. E. Beharrell, Streetly, J. Wright, Stoke Park, and H. Trevaskis, Sutton Coldfield, assignors to Dunlop Rubber Co., Ltd., London, all in England.

2,200,838. **Means to Protect Aircraft from Ice Formation.** E. F. Field, Sutton Coldfield, assignor to Dunlop Rubber Co., Ltd., London, both in England.

2,200,899. **Spacing Means** for Bag Filters. W. H. Scheidt, Wuppertal-Elberfeld, Germany.

2,200,902. **Ladder** with Suction Cups. H. A. Solomon, Syracuse, N. Y.

2,200,916. **Pneumatic Safety Tire.** J. P. Crowley, Toledo, O.

2,200,918. **Sound Record** with a Thin Strip of Chlorinated Rubber. O. M. Dunning, Glen Ridge, and C. T. Jacobs, New Providence Township, assignors to Thomas A. Edison, Inc., West Orange, all in N. J.

2,200,925. **Fluid Seal.** L. A. Johnson, Hillsborough, and A. D. Owen, Berkeley, assignors to National Oil Seal Co., Oakland, all in Calif.

2,200,967. **Air Hose Construction.** J. H. Phillips, Jackson, Mich.

2,201,029. **Atomizer.** C. C. Daggett, assignor to De Vilbiss Co., both of Toledo, O.

2,201,044. **Light Casing.** J. D. Langdon, La Canada, Calif.

2,201,079. **Wringer Mop.** H. J. Camden, Jackson, Mich.

2,201,113. **Metallic Anti-skid Tire Tread.** F. G. Neal, assignor to Springfield Wire & Tinsel Co., both of West Springfield, Mass.

2,201,155. **Deicer.** R. H. Burgess, San Antonio, Tex.

2,201,164. **Duck Decoy.** J. C. Fox, Seattle, Wash.

2,201,246. **Badminton Shuttlecock.** K. A. Sells, Kansas City, Kans.

2,201,250. **Vehicle Wheel Suspension.** C. C. Utz, Detroit, assignor to Chrysler Corp., Highland Park, both in Mich.

2,201,255. **Disposable Diaper Holder.** E. T. Wilson, Jr., Highland Park, N. J.

2,201,258. **Extreme Pressure Lubricant.** W. F. Busse, Akron, O., assignor to B. F. Goodrich Co., New York, N. Y.

2,201,269. **Knitted Elastic Fabric.** J. Markowitz, assignor to Pennant Knitting Mills, Inc., both of Brooklyn, N. Y.

2,201,275. **Storage Battery Cover Assembly.** F. Slusher, Akron, O., assignor to B. F. Goodrich Co., New York, N. Y.

2,201,302. **Rubber Stamp Printing Device.** F. S. Rowe, Bloomfield, N. J., assignor to Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

2,201,315. **Respirator.** W. H. Lehmberg, Sturbridge, assignor to American Optical Co., Southbridge, both in Mass.

2,201,372. **Pipe Coupling.** E. A. Miller, Downey, assignor to Vernon Tool Co., Ltd., Los Angeles, both in Calif.

2,201,404. **Tube and Pipe Coupling.** H. Kreidel, Wiesbaden, Germany, assignor to Patex Societe Anonyme, Basel, Switzerland.

2,201,412. **Tampon.** J. Stein, New York, N. Y.

2,201,422. **Trolley Pole Mounting.** J. D. Beebe, Silver Lake, O., assignor to B. F. Goodrich Co., New York, N. Y.

2,201,424. **Water Bag.** F. Berger, Pasadena, Calif.

2,201,438. **Independent Wheel Suspension.** L. E. Laisne, Levallois Perret, France, assignor to Bendix Aviation Corp., Chicago, Ill.

2,201,485. **Tool Retainer.** F. P. Forss, Aurora, assignor to Independent Pneumatic Tool Co., Chicago, both in Ill.

2,201,486. **Inflated Toy.** S. Gold, Chicago, Ill.
2,201,489. **Emergency Vehicle Wheel.** E. H. Hill, Chicago, Ill.
2,201,496. **Vehicle Curb Indicator.** L. Mohar, Long Beach, Calif.
2,201,510. **Storage Battery Cover Assemly.** H. E. Waner, Akron, O., assignor to B. F. Goodrich Co., New York, N. Y.
2,201,531. **Spring Stabilizer.** F. A. Geb, Dallas, Tex.
2,201,557. **Plain Knit Ornamented Elastic Fabric.** J. L. Getaz, Maryville, Tenn.
2,201,590. **Connector.** B. D. McIntyre, assignor to Monroe Auto Equipment Co., both of Monroe, Mich.
2,201,632. **Anti-skid Device.** L. O. E. Roessel, Chappaqua, assignor of 40% to E. C. Gillette, New York, both in N. Y.
2,201,697. **Golf Practicing Device.** L. T. Martin and C. E. Dodson, both of Kansas City, Mo.
2,201,702. **Pneumatic Heel.** B. Rubel, New York, N. Y.
2,201,755. **Comb.** I. L. Wolkow, Louisville, Ky.
2,201,800. **Mine Car Bumper.** R. A. Shields, Berwick, Pa., assignor to American Car & Foundry Co., New York, N. Y.
2,201,802. **Ball Game.** A. Steiner, Union City, N. J.
2,201,842. **Wringer Rolls.** G. W. Wardwell, Jr., Nichols, and J. I. Arnett, Stratford, both in Conn., assignors to General Electric Co., a corporation of N. Y.
2,201,862. **Pipe Coupling and Gasket.** A. Heisterkamp, Hoboken, N. J.
2,201,877. **Masking Tape.** (Synthetic.) J. F. Anderson, Cuyahoga Falls, O., assignor to B. F. Goodrich Co., New York, N. Y.
2,201,931. **Artificial Leather.** D. J. Sullivan, Fairfield, Conn., assignor to E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.
2,202,020. **Rubber Printing Blanket.** S. B. Neiley, Winchester, assignor to Dewey & Almy Chemical Co., North Combridge, both in Mass.
2,202,047. **Cabinet** for Filing Microscopic Slides. J. C. and I. J. Ehrlich, both of New York, N. Y.
2,202,053. **Typewriter Adjustment Device.** W. F. Helmond, West Hartford, Conn., assignor to Underwood Elliott Fisher Co., New York, N. Y.
2,202,058. **Foundation Garment.** H. V. Malnick, Chicago, Ill.
2,202,080. **Vehicle Wheel.** F. W. Baker, Stourbridge, England.
2,202,102. **Wheel.** H. J. Horn, assignor to Motor Wheel Corp., both of Lansing, Mich.
2,202,114. **Exterior Operating Member** for Watertight Watches. E. Morf, La Chaux-de-Fonds, Switzerland.
2,202,129. **Wheel Balance Weight.** E. W. Turner, Kokomo, Ind., assignor of one-third to himself, one-third to E. E. Turner, one-sixth to E. W. Turner, trustee for J. E. Turner, one-sixth to E. W. Turner, trustee for H. C. Turner.
2,202,195. **Adjustable Swivel Joint.** M. J. Drachman and K. Stoye, assignors to Peerless Laboratories, Inc., all of New York, N. Y.
2,202,250. **Belt Connector.** A. L. Freedlander and N. J. Ritzert, assignors to Dayton Rubber Mfg. Co., all of Dayton, O.
2,202,311. **Windshield Wiper.** F. G. and W. M. Folberth, both of Cleveland, O.
2,202,315. **Resilient Light Socket and Bracket Extension.** J. D. Langdon, Los Angeles, Calif.
2,202,321. **Inflatable Test Plug** for Gas Mains. E. F. Schuldt, Chicago, Ill.
2,202,375. **Supporting Wrapped Meat Cuts.** G. E. Gott, Cambridge, assignor to Dewey & Almy Chemical Co., North Cambridge, both in Mass.
2,202,382. **Trylon and Perisphere Toy.** B. Horton, New York, N. Y.
2,202,393. **Auto Ventilator.** W. L. Morrison, Lake Forest, Ill.
2,202,413. **Adjustable Resilient Mounting** for Electric Motors. C. G. H. Anderson and I. K. Fog, assignors to Sangamo Co., Ltd., all of Toronto, Ont., Canada.
2,202,415. **Self-Inflating Life Preserver.** E. T. Christopher and H. E. Murray, both of Denver, Colo.
2,202,436. **Springing Arrangement** for Vehicle Wheel. O. Siebler, Zwickau, and W. Boxan, Zschopau, assignors to Auto Union Akt., Chemnitz, all in Germany.
2,202,459. **Expansible Gasoline Hose Nozzle.** W. H. Link, assignor to 49% to E. V. Jones, both of Los Angeles, Calif.
2,202,460. **Shock Absorber** for Motor Vehicles. F. F. Maciel, Antioch, Calif.
2,202,516. **Comb Cleaner.** J. J. Calleo, Lodi, N. J.
2,202,518. **Loose-Leaf Binder.** E. N. Farkas, assignor of one-half to F. F. Farkas, both of Chicago, Ill.
2,202,519. **Fish Lure.** (Latex.) M. R. Ferris, La Grange, Ill.
2,202,530. **Brake.** H. C. Liveringhouse, Providence, R. I., assignor to United States Rubber Co., New York, N. Y.
2,202,560. **Shoe Cleaning Shield.** D. C. Kloza, Harrison, N. J.
2,202,577. **Dental Impression Mold.** L. W. Evans, Salineville, O.
2,202,615. **Rubber Springing** for Motor Vehicles. B. Barényi, Paris, France, assignor to Getefo, Gesellschaft für Technischen Fortschritt m.b.H., Berlin, Germany.
2,202,617. **Sealing Conduits.** R. E. Bishop, South Orange, N. J., assignor to A. C. Horn & Co., Long Island City, N. Y.
2,202,653. **Closure Device.** A. R. Glidden, Seattle, Wash.
2,202,656. **Well-Logging Electrode.** C. J. Haynes, Houston, Tex., assignor to Standard Oil Development Co., a corporation of Del.
2,202,660. **Skirt Marker.** M. Ingwer, Forest Hills, assignor to Consolidated Sewing Machine & Supply Co., Inc., New York, both in N. Y.
2,202,697. **Mirror** with Rubber-sealed Panel. W. La Hodny, Buffalo, N. Y.
2,202,701. **Inhalation Apparatus.** H. Lehmann, Hampstead, assignor to Riddell Products, Ltd., both in London, England.
2,202,746. **Self-Centering Spindle** for Spinning Frames. J. Raboisson, assignor to Society: "Manufacture Alsacienne de Broches, Anciennement les Fils d'Edouard Latscha S. a. r. L.", both of Soultz (Haut-Rhin), France.
2,202,775 and 2,202,776. **Release Devices** for Wringers. W. L. Kauffman, II, assignor to Lovell Mfg. Co., both of Erie, Pa.
2,202,777, 2,202,778, and 2,202,779. **Wringers.** W. L. Kauffman, II, assignor to Lovell Mfg. Co., both of Erie, Pa.
2,202,780. **Bearing for Wringers, Etc.** W. L. Kauffman, II, assignor to Lovell Mfg. Co., both of Erie, Pa.
2,202,786. **Elliptic Spring.** T. R. Weber, Latrobe, Pa., assignor to American Locomotive Co., New York, N. Y.

Dominion of Canada

388,490. **Laminated Rubber Shock Absorber.** J. F. Soper, Balclutha, Otago, New Zealand.
388,507. **Badminton Shuttlecock.** Campbell Mfg. Co., Ltd., Leaside, assignee of G. Goodwin, Ottawa, both in Ont.
388,512. **Door Sealing Device.** Canadian General Electric Co., Ltd., assignee of W. J. Kendall, Jr., both of Toronto, Ont.
388,529. **Slit-Tread Tire.** Dominion Rubber Co., Ltd., Montreal, P. Q., assignee of C. M. Sloman, Detroit, and E. S. Ewart, St. Clair Shores, co-inventors, both in Mich., U. S. A.
388,551. **Rim.** Kelsey-Hayes Wheel Co., assignee of F. H. LeJeune and J. E. Copeland, co-inventors, all of Detroit, Mich., U. S. A.
388,616. **Automobile Transmission System** with Flexible Connection between Flywheel and Shaft. M. F. A. Julien, Paris, France.
388,619. **Resilient Cross Link** for Tire Chain. W. J. Lutey, Seattle, Wash., U. S. A.
388,666. **Glass Run Channel.** Detroit Gasket & Mfg. Co., assignee of G. T. Balfe, both of Detroit, Mich., U. S. A.
388,674. **Inflatable-Tube Brake.** B. F. Goodrich Co., New York, N. Y., assignee of W. H. Hunter, Akron, O., both in U. S. A.
388,701. **Paint Brush.** Rubberset Co., Ltd., assignee of L. S. Hewes, both of Gravenhurst, Ont.
388,703. **Air Purifier.** Schmieg Sheet Metal Works, assignee of F. A. Schmieg, both of Detroit, Mich., U. S. A.
388,704. **Vacuum Cleaner Coupling.** Scott & Fetzer Co., Cleveland, assignee of L. W. Pardee, Lakewood, both in O., U. S. A.
388,725. **Shoe Making Method** Utilizing Rubber Lasting Member. United Shoe Machinery Co. of Canada, Ltd., Montreal, P. Q., assignee of J. Cavanagh, Cohasset, Mass., U. S. A.
388,731. **Hose Coupler Lock.** Vapor Car Heating Co., Inc., assignee of E. A. Russell, both of Chicago, and W. W. Wilson, Oak Park, co-inventors, both in Ill., U. S. A.
388,746. **Engine Mounting.** E. P. Renaux, Paris, Seine, and L. J. Renaux, Livry-Gargan, Seine & Oise, co-inventors, both in France.
388,750. **Buoyancy Device.** A. T. Ardern, Mt. Eden, Auckland, New Zealand.
388,752. **Body Supporting Garment.** D. Blair, Chicago, Ill., U. S. A.
388,820. **Wrapping Tissue** Comprising a Cellulose Ether Film Coated with Wax-Rubber Composition. E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., assignee of J. F. Haskins, Hawkesbury, Ont., administrator of the estate of E. C. Ellsworth, deceased, in his lifetime of Gordon Heights, Del., U. S. A.
388,825. **Hydraulic Power Apparatus** for Aircraft. India Rubber, Gutta Percha & Telegraph Works Co., Ltd., assignee of F. J. Tarris and D. Webb, all of London, England.
388,865. **Railway Car Truck and Swing Bolster.** Transit Research Corp., assignee of E. H. Piron, both of New York, N. Y., U. S. A.
388,879. **Hose Clamp Tool.** M. J. McAneny, Jr., Denver, Colo., U. S. A., assignee of M. J. McAneny, Sr., deceased, in his lifetime of Denver.
388,892. **Scalp Cooling Device.** B. B. Cole, Chanute, Kans., U. S. A.
388,896. **Anti-skid Chain Unit** with Rubber Cushions. H. S. Fritts, Washington, N. J., U. S. A.
388,907. **Combination Comb and Brush.** C. J. H. Mackenzie-Kennedy, New York, N. Y., U. S. A.
388,915. **Airplane Armor** Including a Two-Ply Rubber Sheet. G. Provenzano, New York, N. Y., U. S. A.
388,923. **Leg Protector.** A. S. Woare, Shelby Mont., U. S. A.
388,977. **Elasticized Shoe.** Dominion Rubber Co., Ltd., Montreal, P. Q., assignee of E. F. Roberts, Rye, N. Y., U. S. A.
389,065. **Loom Thread Holder.** Crompton & Knowles Loom Works, assignee of R. G. Turner, both of Worcester, Mass., U. S. A.

United Kingdom

516,189. **Eraser Holders.** A. M. I. Phillips.
516,232. **Windshield Wipers.** Houdaille Hydraulic Suspension Co., Ltd., and A. W. King.
516,277. **Windshield Wipers.** J. J. V. Armstrong, (R. Bosch Ges.)
516,285. **Cables.** Pyrotenax, Ltd., F. W. Tomlinson, and C. M. Beckett.
516,382. **Tires.** E. Zipper.
516,623. **Safety Valves** for Automatic Guns on Aircraft. Dunlop Rubber Co., Ltd., G. E. Beharrell, J. Wright, and H. Trevaskis.
516,726. **Anti-skid Device** for Two-tired Wheels. D. S. Kennedy.
516,738. **Aircraft Landing Wheels.** Vickers (Aviation), Ltd., and M. Hare.
516,757. **Palate Suction Devices** for Artificial Upper Denture Members. G. Rechnitz.
516,763. **Printed Maps, Wall Charts, Picture Books, Etc.** Kautschuk Ges. and K. A. Schutz.
516,832. **Saddles** for Cycles, Etc. Dunlop Rubber Co., Ltd., and H. F. Ryan.
516,997. **Resilient Mounting** for Airplane Propellers or Propeller Spinners. M. F. A. Julien and Y. A. Rocard.
517,041. **Fountain Pens.** H. R. Hughes.
517,080. **Elastic Fabrics.** F. Longdon & Co., Ltd., and G. W. Skinner.
517,225. **Cables.** J. E. Brigg.
517,370 and 517,373. **Aircraft Undercarriages** with Resilient Wheel Units. R. H. Bound.
517,380. **Aircraft Undercarriages** with Resilient Wheel Units. G. H. Dowty.
517,388. **Fountain Pens.** E. E. S. Wade.

TRADE MARKS

United States

377,278. **Bermat.** Rubber stamps and office supplies, rubber bands, etc. Bermat Products Corp., New York, N. Y.
377,294. **Taps.** Sponge rubber scented for use as bait in animal traps. L. H. Fowler, Garden City, Long Island, N. Y.
377,329. **Everseal V Packing.** Flexible packing, washers, and disks. Crane Packing Co., Chicago, Ill.
377,367. **Emblem.** Automobile batteries. Sears, Roebuck & Co., Chicago, Ill.
377,372. Representation of the words: **"Hi-Peder"** in a diamond-shaped figure. Foot massager. H. H. Illch, New York, N. Y.
377,463. **"White-Nu."** White sidewall tire cleaner and dresser. Keel & Co., Inc., Philadelphia, Pa.
377,565. **Toplicator.** Pliofilm containers for medicinal preparations. Schering Corp., Bloomfield, N. J.
377,593. **Milky Way.** Rubber baby pants. Milky Way Products Co., Wilmington, Del.
377,606. **Senator.** Tires and tubes. Abel Sales Corp., Columbus, O.
377,610. **Goodflex.** Power transmission belts. B. F. Goodrich Co., Akron, O.
377,631. **Cross Country.** Battery cables. Sears, Roebuck & Co., Chicago, Ill.
377,699. **Ariette.** Foundation garments, garter belts, etc. Maiden Form Brassiere Co., Inc., New York, N. Y.
377,740. **Jantee-Pantee.** Swimming suits and girdles. Jantzen Knitting Mills, Portland, Oreg.
377,748. **Newing.** Belts, baby pants, and garters. J. A. Armstrong & Sons, Inc., Boston, Mass.
377,753. **Puss-Pads.** Footwear. S. Dorée, doing business as "Designs Silvia Dorée," New York, N. Y.
377,758. **Gay-Baby.** Foundation garments. Chevette, Inc., New York, N. Y.
377,762. **'Teen Treasure.** Girls' garments, gloves, and footwear. Gimbel Bros., Inc., New York, N. Y.
377,767. **Wrap-Ture.** Foundation garments and underwear. La Resista Corset Co., Bridgeport, Conn.
377,776. **Tor-Flex.** Rubber base paints and paint coatings. Coppercote, Inc., New York, N. Y.
377,780. **Multi-Duty.** Tires. Fisk Rubber Corp., Chicopee Falls, Mass., assignor to United States Rubber Co., New York, N. Y.
377,783. **Golfoccasins.** Footwear. Service Boot & Legging Co., Inc., New York, N. Y.
377,789. **Aqualastic.** Elastic piece goods. B. V. D. Corp., New York, N. Y.
377,790. **Patrician.** Tires. B. F. Goodrich Co., New York, N. Y.

Market Reviews

CRUDE RUBBER

Commodity Exchange

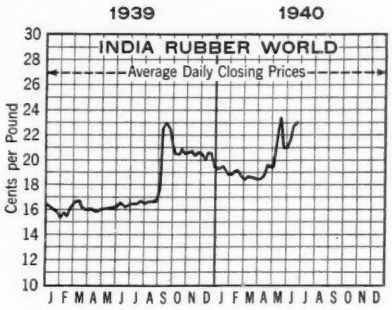
TABULATED WEEK-END CLOSING PRICES ON THE NEW YORK MARKET

Futures	Apr. 27	May 25	June 1	June 8	June 15	June 22
May ...	19.24	20.17	.....	.....	.....	.....
June ...	19.05	19.75	22.00	21.63	22.25	23.12
July ...	18.85	19.30	21.50	21.33	21.95	22.80
Sept. ...	18.62	18.18	19.40	19.55	19.96	20.14
Dec. ...	18.40	17.80	18.75	18.80	18.90	18.81
Mar. ...	18.25	17.50	18.45	18.35	18.53	18.46
May ...	.....	.....	18.40	18.28	18.46	18.39
Volume per week (tons)..	8,880	11,040	5,890	4,650	8,160	4,930

ITALY'S entrance into the European war, labor troubles in the Far East, and higher freight and war risk insurance rates, all had their effect on the rubber market here last month. After closing at 18.10¢ per pound on May 29, September futures (old contract) moved sharply upward to reach 21.05¢ per pound on June 11. This was followed by a period of somewhat easier prices, and the September position closed at 20.14¢ per pound on June 22. Thereafter the market was slow, and the closing price on June 29 was 18.88¢ per pound. Trading volume during the month was light, as a result of the international uncertainties. A wide spread was maintained between nearby and distant months.

Freight rates on rubber from Singapore to New York will be increased 20% to $21.50 per 50 cubic feet, effective August 1. Similarly freight rates on rubber from Batavia, now quoted $12.50 per cubic meter, will be raised to $15 on that date. During the past month war risk insurance on all foreign vessels using the Cape of Good Hope route was advanced from 2% to 3%. American-flag boats were unaffected by this advance. However, war risk insurance rates on shipments via the Panama Canal and on trans-Pacific shipments were advanced, in the case of American vessels, from ¾% to 1%; while on all foreign bottoms the increase was 1% to 2%.

Foreign exchange institutions possessing outstanding contracts in Dutch guilders, as a result of contracts for rubber placed before the German invasion of Holland, were told by the Bankers Foreign Exchange Committee on June 4 that they would have to make their settlements on an individual basis. The bankers' group failed to find a general solution to the problem. Estimates as to the amount of rubber involved ranged from 5,000 to 20,000 tons. It was reported late last month that most local dealers here were believed to have completed arrangements for substituting dollars for guilders in their contracts, thereby releasing the rubber consignments involved. The trade here were said to have worked together on this problem and that an equitable adjustment was arranged.



New York Outside Market—Spot Ribbed Smoked Sheets

It was understood that government measures were being taken to restore normal conditions at the Singapore godowns (rubber warehouses) where a strike was causing some concern as to the possibility of shipment delays.

Following our prediction last month, United States crude rubber consumption during May of 51,619 long tons was somewhat higher than the April figure of 50,103 long tons. Currently, consumption here is being well maintained, and June consumption should be in the neighborhood of 50,000 tons.

According to the Department of Commerce, arrivals of rubber in May were 51,431 long tons. Reexports of rubber in May, according to preliminary reports, amounted to 810 tons, somewhat higher than the revised figure of 564 tons for April.

New York Outside Market

Activity in the outside market was reported generally quiet during June. Shipment offerings from the Far East were limited, and factories in general were awaiting a clarification of the international situation before making commitments. The price of No. 1 ribbed smoked sheets, which closed at 20½¢ per pound on May 28, rose sharply to 23½¢ per pound on June 11. After this the market held fairly steady, closing at 23¼¢ per pound on June 22. The closing price on June 29 was 21½¢ per pound, with the market moderate.

The week-end closing prices on No. 1 ribbed smoked sheets follow: June 1, 22¢; June 8, 21¾¢; June 15, 22¾¢; June 22, 23¼¢.

New York Quotations

New York outside market rubber quotations in cents per pound

	June 27, 1939	May 28, 1940	June 26, 1940
Plantations			
Rubber latex..*gal.*	60/61	78/79	84/85
Paras			
Upriver fine.....	14⅜	19¼	20¼
Upriver fine.....	*16⅜	*22	*22½
Upriver coarse ...	10	12	12
Upriver coarse ...	*15¼	*19½	*19
Islands fine.....	14	19	18
Islands fine.....	*16¼	*21½	*22
Acre, Bolivian fine	14½	19½	20½
Acre, Bolivian fine	*16¾	*22¼	*23
Beni, Bolivian fine	15	20½	21
Madeira fine	14⅜	19¼	20¼
Caucho			
Upper ball	10	12	12
Upper ball	*15¾	*19½	*19
Lower ball	9½	11	11½
Pontianak			
Pressed block	9/16	13/18	17½/20
Guayule			
Ampar	13¼	15	15
Africans			
Rio Nuñez	14	18½	18½
Black Kassai	14	18½	18½
Prime Niger flake	25	22½	22½
Gutta Percha			
Gutta Siak	9¾	19¼	21/22½
Gutta Soh	15	30	30
Red Macassar ...	90/1.20	1.20	1.20
Balata			
Block Ciudad Bolivar	..	..	..
Manaos block ...	31	..	..
Surinam sheets ..	40	50	..
Amber	42	55	..

* Washed and dried crepe. Shipments from Brazil.

Precipitated Calcium Silicate

A white reenforcing pigment which is said to give high abrasion and tear resistance to synthetic and natural rubber has just appeared on the market. More information will appear later.

New York Outside Market—Spot Closing Prices—Plantation Grades—Cents per Pound

	May, 1940				June, 1940																
	27	28	29	30*	31	1	3	4	5	6	7	8	10	11	12	13	14	15	17	18	19	20	21	22
No. 1 Ribbed Smoked Sheet.	20¾	20½	20¾	..	21¾	22	21½	21¾	21½	21⅝	21¾	21¾	22½	23½	23	22½	22¾	22¾	22¾	22¾	23	23¼	23¼	23¼
No. 1 Thin Latex Crepe.....	20¾	20½	20¾	..	21¾	22	21½	21¾	21½	21⅝	21¾	21¾	22½	23½	23	22½	22¾	22¾	22¾	22¾	23	23¼	23¼	23¼
No. 2 Thick Latex Crepe....	20¾	20½	20¾	..	21¾	22	21½	21¾	21½	21⅝	21¾	21¾	22½	23½	23	22½	22¾	22¾	22¾	22¾	23	23¼	23¼	23¼
No. 1 Brown Crepe.....	19½	19¼	19½	..	20	20¾	20¼	20½	20¼	20⅜	20½	20½	21¼	22¼	21¾	21¼	21½	21½	21½	21½	21¾	22	22	22
No. 2 Brown Crepe.....	19¼	19	19¼	..	19¾	20½	20	20¼	20	20⅛	20¼	20¼	21	22	21½	21	21¼	21¾	21¾	21¾	21½	21¾	21¾	21¾
No. 2 Amber.....	19½	19¼	19½	..	20	20¾	20¼	20½	20¼	20⅜	20½	20½	21¼	22¼	21¾	21¼	21½	21½	21½	21½	21¾	22	22	22
No. 3 Amber.....	19¼	19	19¼	..	19¾	20½	20	20¼	20	20⅛	20¼	20¼	21	22	21½	21	21¼	21¾	21¾	21¾	21½	21¾	21¾	21¾
Rolled Brown.....	15½	15¼	15½	..	16	17½	17	17¼	17	17⅛	17¼	17¼	18	19	18½	18	18¼	18¼	18¼	18¼	18½	18¾	18¾	18¾

*Holiday

ADVERTISING PAGES REMOVED

IMPORTS, CONSUMPTION, AND STOCKS

United States and World Statistics of Rubber Imports, Exports, Consumption, and Stocks—Long Tons

Twelve Months	U.S. Imports*	U.S. Consumption¶	U.S. Stocks Mfrs., Dealers, Importers, Etc.†¶	U.S. Stocks Afloat	U.K.—Public Warehouses, London, Liverpool†‡	Singapore and Penang Dealers and Port Stocks†‡	World Production (Net Exports)‡	World Consumption Estimated‡	World Stocks†‡§
1937	584,851	543,600	262,204	63,099	57,785	44,792	1,139,800	1,105,002	646,252
1938	400,178	437,031	231,500	45,105	86,853	27,084	894,900	942,252	596,498
1939	499,473	592,000	125,800	91,095	44,917*a*	15,299	1,004,515	1,103,692	447,666*a*
1940									
Jan.	72,496	54,978	142,368*b*	90,285*b*	.....	35,928	108,710	98,049	.....
Feb.	43,088	49,832	134,328*b*	112,257*b*	.....	33,563	113,158	95,253	.....
Mar.	59,258	50,192	142,414*b*	113,619*b*	.....	23,830	112,219	90,422	.....
Apr.	70,699	50,103	162,459*b*	102,557*b*	.....	42,239	90,116	98,664	.....
May	51,431	51,619	161,446*b*	109,364*b*	.....	.....	.....	.....	.....

*Including liquid latex. †Stocks on hand the last of the month or year. ‡*Statistical Bulletin of the International Rubber Regulation Committee.* §Stocks at U. S. A., U. K., Singapore and Penang, Para, Manaos, regulated areas, and afloat. ¶Corrected to 100% from estimate of reported coverage. *a.* Stocks as of Aug. 31, 1939. *b.* Includes government barter rubber.

RECLAIMED RUBBER

ACCORDING to R. M. A. figures, May reclaimed rubber consumption is estimated at 15,719 long tons, 3.6% below that of April; production, 17,552 long tons; and stocks on hand May 31, 28,397 long tons. The demand for reclaim during June was reported to be somewhat better than in May. The insulated wire industry, which had been slow, showed definite signs of picking up, and this was reflected in increased demand for reclaim. The footwear and mechanical goods industries also showed good demand for reclaim.

Despite the strength in the crude rubber market, reclaim prices are yet unaffected, and all grades hold steady at last month's levels.

New York Quotations

June 24, 1940

	Sp. Grav.	¢ per lb.
Auto Tire		
Black Select	1.16-1.18	6 / 6¼
Acid	1.18-1.22	7 / 7¼
Shoe		
Standard	1.56-1.60	6⅛/ 6¼
Tubes		
Red Tube	1.15-1.30	9 / 9¼
Compound	1.10-1.20	9 /10
Miscellaneous		
Mechanical Blends	1.25-1.50	4⅛/ 5
White	1.35-1.50	12½/14

The above list includes those items or classes only that determine the price basis of all derivative reclaim grades. Every manufacturer produces a variety of special reclaims in each general group separately featuring characteristic properties of quality, workability, and gravity at special prices.

RUBBER SCRAP

THE demand for scrap rubber continued good during June. The smaller dealers were said to be withholding their scrap in hopes of higher prices. The market is steady, and all grades remain unchanged at last month's quotations.

Consumers' Buying Prices

(Carlot Lots for June 24, 1940)

		Prices
Boots and Shoes		
Boots and shoes, black	*lb.*	$0.01⅛/$0.01¼
Colored	*lb.*	.00⅞/ .01
Untrimmed arctics	*lb.*	.00⅞/ .01
Inner Tubes		
No. 1, floating	*lb.*	.10 / .10½
No. 2, compound	*lb.*	.04⅝/ .04⅞
Red	*lb.*	.04½/ .04¾
Mixed tubes	*lb.*	.03⅞/ .04¼
Tires (Akron District)		
Pneumatic Standard		
Mixed auto tires with beads	*ton*	14.50 /15.50
Beadless	*ton*	18.00 /18.50
Auto tire carcass	*ton*	30.00 /35.00
Black auto peelings	*ton*	26.00 /27.00
Solid		
Clean mixed truck	*ton*	34.00 /35.00
Light gravity	*ton*	42.00 /44.00
Mechanicals		
Mixed black scrap	*ton*	22.00 /24.00
Hose, air brake	*ton*	20.00 /22.50
Garden, rubber covered	*ton*	12.50 /14.00
Steam and water, soft	*ton*	12.50 /14.00
No. 1 red	*lb.*	.03 / .03¼
No. 2 red	*lb.*	.02¼/ .02½
White druggists' sundries	*lb.*	.03¼/ .04
Mixed mechanicals	*lb.*	.02¼/ .02½
White mechanicals	*lb.*	.03⅝/ .03¾
Hard Rubber		
No. 1 hard rubber	*lb.*	.11½/ .13

United States Reclaimed Rubber Statistics—Long Tons

Year	Production†	Consumption†	Consumption % of Crude	U. S. Stocks*†	Exports
1938	122,403	120,800	27.6	23,000	7,403
1939	186,000	170,000	28.7	25,250	12,611
1940					
Jan.	19,297	16,070	29.2	27,418	1,059
Feb.	17,992	15,370	30.8	28,602	1,436
Mar.	17,234	15,931	31.7	28,488	1,420
Apr.	16,568	16,298	32.5	27,558	977
May	17,552	15,719	30.5	28,397	....

*Stocks on hand the last of the month or year. †Corrected to 100% from estimate of reported coverage. *Compiled by The Rubber Manufacturers Association, Inc.*

THE R. M. A. estimates United States rubber manufacturers consumed 51,619 long tons of crude rubber during May, 3% over the April consumption of 50,103 long tons and 13.5% above the 45,484 (revised) long tons for May, 1939.

Gross imports for May, as reported by the Department of Commerce, were 51,431 long tons, 27.3% under the April figure of 70,699 long tons, but 12.1% over the 45,886 long tons imported in May, 1939.

Total domestic stocks, estimated by the R. M. A., on May 31 are 161,446 long tons, less than 1% under the 162,459 (revised) long tons on hand April 30, and 14.1% under the 187,980 (revised) long tons, on hand May 31, 1939.

Crude rubber afloat to U. S. ports on May 31 is estimated at 109,364 long tons, against 102,557 long tons on April 30, and 54,046 long tons afloat May 31, 1939.

The figure for U. S. stocks on May 31 includes 19,557 long tons of government emergency rubber. The amount of barter rubber afloat May 31 is not available for publication.

Tire Production Statistics

Pneumatic Casings

	Inventory	Production	Shipments
1938	**8,451,390**	**40,906,735**	**43,132,302**
1939	8,664,505	57,612,731	57,508,775
1940			
Jan.	9,347,953	4,953,585	4,270,137
Feb.	10,123,824	4,888,250	4,112,379
Mar.	10,747,370	5,007,042	4,345,674
Apr.	10,881,029	5,105,953	5,009,762
May	10,576,217	5,415,314	5,720,249

Pneumatic Casings

	Original Equipment	Replacement Sales	Export Sales
1938	**10,716,130**	**30,565,008**	**1,048,934**
1939	18,207,556	38,022,034	1,279,185
1940			
Jan.	1,804,826	2,376,455	88,856
Feb.	1,974,466	2,051,487	86,426
Mar.	2,050,250	2,217,627	77,797
Apr.	2,095,220	2,823,293	91,249
May	1,998,735	3,635,652	85,862

Inner Tubes

	Inventory	Production	Shipments
1938	**8,165,696**	**37,847,656**	**40,292,614**
1939	7,035,671	50,648,556	51,190,314
1940			
Jan.	**7,633,798**	**4,286,924**	**3,826,667**
Feb.	7,896,960	4,210,904	3,809,733
Mar.	8,182,655	4,399,550	4,113,735
Apr.	8,258,331	4,618,361	4,542,735
May	8,243,050	4,739,072	4,738,668

Source: The Rubber Manufacturers Association, Inc. Figures adjusted to represent 100% of the industry.

United States Latex Imports

Year	Pounds (d.r.c.)	Value
1938	26,606,048	$ 4,147,318
1939	61,460,003	10,467,552
1940		
Jan.	7,639,568	1,412,728
Feb.	4,862,684	947,524
Mar.	7,561,780	1,473,056
Apr.	8,430,063	1,608,156

Data from Leather and Rubber Division, Washington, D. C.

COMPOUNDING INGREDIENTS

DEMAND for compounding ingredients by the rubber industry during June continued in general at the high level of May. Toward the end of the month, however, a slackening in demand was noted in some quarters. A seasonal decline in activity may be expected during July. The major feature of the market was an increase in the price of carbon black, which is reported below. Other prices in general are unchanged.

CARBON BLACK. Effective July 1, the price of carbon black was advanced 0.275¢ per pound in bags and 0.25¢ per pound in bulk. The new prices, f.o.b. works, are 2.925¢ per pound in bags and 2.75¢ in bulk. Export prices were unaffected by the announcement. The demand from tire makers, which showed signs of falling off during the first part of June, picked up measureably after the price advance was announced. Actual consumption demand is expected to be seasonally lighter during July and August. Producers' stocks of black at the end of May were estimated at 129,000,000 pounds, a gain of 4,000,000 pounds over the preceding month.

FACTICE OR RUBBER SUBSTITUTE. The demand was fair. Prices are generally unchanged, but an advance during the summer is anticipated.

LITHARGE. The demand was fair, and prices are steady.

LITHOPONE. The demand was reported to be satisfactory, and the price is unchanged.

RUBBER CHEMICALS. The demand for accelerators and antioxidants showed a slight decline toward the end of June. Prices in general are unchanged.

RUBBER SOLVENTS. The demand continued to hold at good levels. Prices are firm and unchanged.

TITANIUM PIGMENTS. The demand from the rubber industry has continued to increase, and current withdrawals are considered good. Prices for the third quarter are unchanged, and contracting for this period is well under way.

ZINC OXIDE. Sales to the rubber industry slowed down somewhat, it is reported. A renewal of heavy demand is expected toward the end of July. Contract prices for the third quarter are unchanged.

Current Quotations*

Abrasives

Pumicestone, powdered	lb.	$0.03 / $.035
Rottenstone, domestic	lb.	.03 / .035
Silica, 15	ton	

Accelerators, Inorganic

Lime, hydrated, *l.c.l.*, New York	ton	20.00
Litharge (commercial)	lb.	.0675/ .0725

Accelerators, Organic

A-1	lb.	.24 / .30
A-10	lb.	.31 / .35
A-11	lb.	.52 / .65
A-19	lb.	.52 / .65
A-32	lb.	.70 / .80
A-77	lb.	.42 / .55
A-100	lb.	.42 / .55
Accelerator 49	lb.	.40 / .42
737	lb.	.42 / .43
737-50	lb.	.25 / .26
808	lb.	.70 / .72
833	lb.	1.15
Acrin	lb.	.60
Aldehyde ammonia	lb.	.65 / .70
Altax	lb.	.55 / .60
B-J-F	lb.	.50 / .55
Beutene	lb.	.70 / .75
Butyl Eight	lb.	.98 / 1.00
Zimate	lb.	2.50
C-P-B	lb.	2.00
Captax	lb.	.50 / .55
Crylene	lb.	.40 / .47
Paste	lb.	.30 / .36
D-B-A	lb.	2.00
Delac A	lb.	.40 / .50
O	lb.	.40 / .50
P	lb.	.40 / .50
Di-Esterex-N	lb.	.60 / .70
DOTG (Di-ortho-tolyguanidine)	lb.	.44 / .46
DPG (Diphenylguanidine)	lb.	.35 / .45
El-Sixty	lb.	.50 / .65
Ethylideneaniline	lb.	.42 / .43
Ethyl Zimate	lb.	2.50
Formaldehyde P.A.C.	lb.	.0625
Formaldehydeaniline	lb.	.31
Formaldehyde-para-toluidine	lb.	.52 / .54
Guantal	lb.	.40 / .50
Hepteen	lb.	.35 / .40
Base	lb.	1.35 / 1.50
Hexamethylenetetramine U.S.P.	lb.	$0.39
Technical	lb.	.33
Lead oleate, No. 999	lb.	.13
Witco	lb.	.15
Ledate	lb.	2.35
Monex	lb.	2.35
Novex	lb.	
O-N-V	lb.	1.00 /$1.10
O-X-A-F	lb.	.50 / .55
Ovac	lb.	.50 / .55
Para-nitroso-dimethylaniline	lb.	.85
Pentex	lb.	1.00 / 1.10
Flour	lb.	.15 / .16
Phenex	lb.	.50 / .55
Pip-Pip	lb.	2.50
Pipsolene	lb.	1.55 / 1.85
R-2	lb.	1.40 / 1.80
R-23	lb.	.40
R & H 50-D	lb.	.42 / .43
Rotax	lb.	.60 / .65
Safex	lb.	1.20 / 1.30
Santocure	lb.	.80 / 1.00
Selenac	lb.	2.75
SPDX	lb.	.70 / .75
Super-sulphur No. 1	lb.	.50
2	lb.	.18 / .20
Tetrone A	lb.	2.70
Thiocarbanilide	lb.	.24 / .30
Thionex	lb.	2.35
Thiurad	lb.	2.35
Trimene	lb.	.55 / .65
Base	lb.	1.05 / 1.20
Triphenylguanidine (TPG)	lb.	.45
Tuads	lb.	2.35
Ulto	lb.	1.25 / 1.75
Ureka	lb.	.60 / .75
Blend B	lb.	.60 / .75
C	lb.	.56 / .65
Vulcanex	lb.	.42 / .43
Vulcanol	lb.	.85
Z-B-X	lb.	2.50
Zenite	lb.	.46 / .48
A	lb.	.53 / .55
B	lb.	.46 / .48
Zimate	lb.	2.35

Activators

Aero Ac 50	lb.	.46 / .56
Barak	lb.	.50
MODX	lb.	.30 / .35
SL No. 10	lb.	.11 / .14

Age Resisters

AgeRite Alba	lb.	1.50 / 1.65
Exel	lb.	1.00 / 1.02
Gel	lb.	.57 / .59
Hipar	lb.	.65 / .67
Powder	lb.	.52 / .54
AgeRite Resin	lb.	.52 / .54
D	lb.	.52 / .54
White	lb.	1.25 / 1.40
Akroflex C	lb.	.56 / .58
Albasan	lb.	.70 / .75
Aminox	lb.	$0.52 /$0.61
Antox	lb.	.56
B-L-E	lb.	.52 / .61
Powder	lb.	.65 / .74
B-X-A	lb.	.52 / .61
Copper Inhibitor X-872-A	lb.	1.15
Flectol B	lb.	.52 / .65
H	lb.	.52 / .65
White	lb.	.90 / 1.15
M-U-F	lb.	1.50
Neozone (standard)	lb.	.63
A	lb.	.52 / .54
B	lb.	.63
C	lb.	.52 / .54
D	lb.	.52 / .54
E	lb.	.63
Oxynone	lb.	.64 / .80
Parazone	lb.	.68
Permalux	lb.	1.20
Santoflex B	lb.	.52 / .65
Solux	lb.	1.30
Stabilite	lb.	.52 / .54
Alba	lb.	.70 / .75
Thermoflex A	lb.	.65 / .67
Tysonite	lb.	.16
V-G-B	lb.	.52 / .61

Alkalies

Caustic soda, flake, Columbia (400-*lb. drums*)	100 *lbs.*	2.70 / 3.55
liquid, 50%	100 *lbs.*	1.95
solid (700-*lb. drums*)	100 *lbs.*	2.30 / 3.15

Antiscorch Materials

A-F-B	lb.	.35 / .40
Antiscorch T	lb.	.90
Cumar RH	lb.	.10
E-S-E-N	lb.	.35 / .40
R-17 Resin (*drums*)	lb.	.10
RM	lb.	1.25
Retarder W	lb.	.36
Retardex	lb.	.45 / .48
U-T-B	lb.	.35 / .40

Antisun Materials

Heliozone	lb.	.22 / .23
S.C.R.	lb.	.33 / .35
Sunproof	lb.	.22 / .27

Brake Lining Saturant

B.R.T. No. 3	lb.	.0165/ .0175

Colors

Black

Du Pont powder	lb.	.42 / .44
Lampblack (commercial), *l.c.l.*	lb.	.15

Blue

Brilliant	lb.	
Du Pont dispersed	lb.	.83 / 3.95
Powders	lb.	2.25 / 3.75
Toners	lb.	.08 / 3.85

Brown

Mapico	lb.	.11

Green

Brilliant	lb.	
Chrome, light	lb.	
medium	lb.	.22
oxide (*freight allowed*)	lb.	
Dark	lb.	
Du Pont dispersed	lb.	.98 / 1.75
Powders	lb.	1.00 / 5.50
Guignet's (*bbls.*)	lb.	.70
Light	lb.	
Toners	lb.	.85 / 3.75

Orange

Du Pont dispersed	lb.	.88 / .98
Powders	lb.	.88 / 2.75
Lake	lb.	
Toners	lb.	.40 / 1.60

Orchid

Toners	lb.	1.50 / 2.00

Pink

Toners	lb.	1.50 / 2.00

Purple

Permanent	lb.	
Toners	lb.	.60 / 2.10

Red

Antimony Crimson, 15/17%	lb.	
R. M. P. No. 3	lb.	.48
Sulphur free	lb.	
R.M.P.	lb.	.52
Golden 15/17%	lb.	
7-A	lb.	.37
Z-2	lb.	.23
Cadmium, light (400-*lb. bbls.*)	lb.	.75 / .80
Chinese	lb.	
Crimson	lb.	
Du Pont dispersed	lb.	.93 / 2.05
Powders	lb.	.285 / .90
Mapico	lb.	.0925
Medium	lb.	
Rub-Er-Red (*bbls.*)	lb.	.0925
Scarlet	lb.	.08 / 2.00
Toners	lb.	.08 / 2.00

*Prices in general are f.o.b. works. Range indicates grade or quantity variations. Space limitation prevents listing all known ingredients. Requests for information not recorded will receive prompt attention.

White

Lithopone (*bags*)	*lb.*	$0.0360/$0.0385
Albalith	*lb.*	.0360/ .0385
Astrolith (50-*lb. bags*)	*lb.*	.0360/ .0385
Azolith	*lb.*	.0360/ .0385
Cryptone-BA-19	*lb.*	.05 / .0525
BT	*lb.*	.05 / .0525
CB	*lb.*	.05 / .0525
ZS No. 20	*lb.*	.075 / .0775
86	*lb.*	.075 / .0775
230	*lb.*	.075 / .0775
800	*lb.*	
Sunolith	*lb.*	.0360/ .0385
Ray-Bar	*lb.*	.0525/ .0575
Ray-Cal	*lb.*	.05 / .0525
Rayox	*lb.*	.13
Titanolith (50-*lb. bags*)	*lb.*	.05 / .0525
Titanox-A (50-*lb. bags*)	*lb.*	.13 / 1375
B (50-*lb. bags*)	*lb.*	.0525/ .0550
30 (50-*lb. bags*)	*lb.*	.0525/ .0550
C (50-*lb. bags*)	*lb.*	.05 / .0525
M (50-*lb. bags*)	*lb.*	.0525/ .0550
Ti-Tone	*lb.*	
Zinc Oxide		
Azo ZZZ-11	*lb.*	.0625/ .0650
44	*lb.*	.0625/ .0650
55	*lb.*	.0625/ .0650
66	*lb.*	.0625/ .0650
French Process, Florence		
Green Seal-8	*lb.*	.08 / .0825
Red Seal-9	*lb.*	.075 / .0775
White Seal-7	*lb.*	.085 / .0875
Kadox, Black Label-15	*lb.*	.065 / .0675
No. 25	*lb.*	.075 / .0775
Red Label-17	*lb.*	.065 / .0675
Horse Head Special 3	*lb.*	.0625/ .065
XX Red-4	*lb.*	.0625/ .065
23	*lb.*	.0625/ .065
72	*lb.*	.0625/ .065
78	*lb.*	.0625/ .065
80	*lb.*	.0625/ .065
103	*lb.*	.0625/ .065
110	*lb.*	.0625/ .065
St. Joe (lead free)		
Black Label	*lb.*	.0625/ .065
Green Label	*lb.*	.0625/ .065
Red Label	*lb.*	.0625/ .065
U.S.P.	*lb.*	.095 / .0975
White Jack	*lb.*	.075 / .0775
Zopaque (50-*lb. bags*)	*lb.*	.13 / .1375

Yellow

Cadmolith (cadmium yellow), (400-*lb. bbls.*)	*lb.*	.50 / .55
Du Pont dispersed	*lb.*	1.25 / 1.75
Powders	*lb.*	.135 / 2.75
Lemon	*lb.*	
Mapico	*lb.*	.0675
Toners	*lb.*	2.50

Dispersing Agents

Bardex	*lb.*	.0395/ .042
Bardol	*lb.*	.0225/ .045
Darvan	*lb.*	.30 / .39
Nevoll (*drums, c.l.*)	*lb.*	.0225
Santomerse S	*lb.*	.11 / .25

Fillers, Inert

Asbestine, *c.l.*	*ton*	15.00
Barytes	*ton*	30.00 /36.00
f.o.b., St. Louis (50-*lb. paper bags*)	*ton*	22.85
off color, domestic	*ton*	20.00 /25.00
white, imported	*ton*	29.00 /32.00
Blanc fixe, dry, precip.	*lb.*	.03 / .035
Calcene	*ton*	37.50 /43.00
Infusorial earth	*lb.*	.02 / .03
Kalite No. 1	*ton*	24.00 /30.00
3	*ton*	34.00 /40.00
Kalvan	*ton*	121.00
Magnesia, calcined, heavy	*lb.*	.04
Carbonate, *l.c.l.*	*lb.*	.0725/ .095
Paradene No. 2 (*drums*)	*lb.*	.045
Pyrax A	*ton*	6.00 /20.00
Whiting		
Columbia Filler	*ton*	9.00 /14.00
Suprex, white extra light	*ton*	45.00
heavy	*ton*	45.00
Witco, *c.l.*	*ton*	6.00

Finishes

Rubber lacquer, clear	*gal.*	
colored	*gal.*	
Starch, corn, pwd.	100 *lbs.*	
potato	*lb.*	
Talc	*ton*	.025 / .035

Flock

Cotton flock, dark	*lb.*	.10 / .12
dyed	*lb.*	.40 / .80
white	*lb.*	.11 / .20
Rayon flock, colored	*lb.*	1.00 / 2.00
white	*lb.*	.75 / 1.00

Latex Compounding Ingredients

Accelerator 85	*lb.*	.35
89	*lb.*	1.40
122	*lb.*	1.55
552	*lb.*	2.50
Aerosol OT Aqueous 10%	*lb.*	.15 / .175
Antox, dispersed	*lb.*	.42
Aquarex A	*lb.*	.35
D	*lb.*	.75
F	*lb.*	.85
WA Paste	*lb.*	.28
Areskap No. 50	*lb.*	$0.18 /$0.24
100, dry	*lb.*	.39 / .51
Aresket No. 240	*lb.*	.16 / .22
300, dry	*lb.*	.42 / .50
Aresklene No. 375	*lb.*	.35 / .50
400, dry	*lb.*	.51 / .65
Black No. 25, dispersed	*lb.*	.22 / .40
Collocarb	*lb.*	.07
Color Pastes, dispersed	*lb.*	.35 / 1.90
Compound G-11 NW	*lb.*	
Dispersex No. 15	*lb.*	.11 / .12
No. 20	*lb.*	.08 / .10
Emo, brown	*lb.*	.16
white	*lb.*	.16
Factice Compound, dispersed	*lb.*	.36
Heliozone, dispersed	*lb.*	.25
Igepon A	*lb.*	
Latac	*lb.*	
MICRONEX, Colloidal	*lb.*	.055 / .0655
Nekal BX (dry)	*lb.*	
Pipsol X	*lb.*	3.05 / 3.55
R-2 Crystals	*lb.*	2.50 / 2.75
R-23	*lb.*	.40
RN-2	*lb.*	2.00 / 2.25
Crystals	*lb.*	2.00 / 2.25
S-1 (400-*lb. drums*)	*lb.*	.65
Santobrite Briquettes	*lb.*	.17 / .26
Powder	*lb.*	.16 / .26
Santomerse D	*lb.*	.41 / .65
S	*lb.*	.11 / .25
No. 1	*lb.*	.18 / .35
No. 2	*lb.*	.18 / .35
No. 3	*lb.*	.40 / .65
No. 3P	*lb.*	.29 / .45
Santovar A	*lb.*	1.15 / 1.40
Stablex A	*lb.*	.90 / 1.10
B	*lb.*	.65 / .90
C	*lb.*	.40 / .50
Sulphur, dispersed	*lb.*	.10 / .15
No. 2	*lb.*	.075
T-1 (400-*lb. drums*)	*lb.*	.40
Tepidone	*lb.*	1.20
Vulcan Colors	*lb.*	
Zinc oxide, dispersed	*lb.*	.12 / .15

Mineral Rubber

Black Diamond	*ton*	25.00
B.R.C. No. 20	*lb.*	.009 / .01
Hydrocarbon, hard	*ton*	23.00
Genasco Hydrocarbon, granulated	*ton*	
solid	*ton*	
Gilsonite	*ton*	
Parmr	*ton*	
Pioneer	*ton*	
285°-300°	*ton*	23.00 /42.00

Mold Lubricants

Lubrex	*lb.*	.25 / .30
Mold Paste	*lb.*	.12 / .18
Sericite	*ton*	65.00 /75.00
Soapbark	*lb.*	
Soapstone, *l.c.l.*	*ton*	25.00 /35.00

Oil Resistant

AXF	*lb.*	.40 / .50

Reclaiming Oils

B.R.V.	*lb.*	.032 / .0345
No. 1621	*lb.*	.019 / .02
S.R.O.	*lb.*	.019 / .02
X-159	*gal.*	.20

Reenforcers

Carbon Black

Aerfloted Arrow Specification (*bags only*)	*lb.*	.02925†
Arrow Compact Granulized	*lb.*	.02925†
Certified Heavy Compressed (*bags only*)	*lb.*	.02925†
Spheron	*lb.*	.02925†
Continental, dustless	*lb.*	.02925†
Compressed (*bags only*)	*lb.*	.02925†
Disperso	*lb.*	.02925†
Dixie	*lb.*	.02925†
Dixiedensed	*lb.*	.02925†
66	*lb.*	.02925†
Excello, dustless	*lb.*	.02925†
Fumonex	*lb.*	.03
Gastex	*lb.*	.03 / .07
Kosmobile	*lb.*	.02925†
66	*lb.*	.02925†
Kosmos	*lb.*	.02925†
MICRONEX Beads	*lb.*	.02925†
Mark II	*lb.*	.02925†
Standard	*lb.*	.02925†
W-5	*lb.*	.02925†
W-6	*lb.*	.02925†
P-33	*lb.*	.0475 / .0725
Pelletex	*lb.*	.03 / .07
Supreme, dustless	*lb.*	.02925†
Thermax	*lb.*	.02 / .0475
Velvetex	*lb.*	.022 / .035
"WYEX BLACK"	*lb.*	.02925†
Carbonex	*lb.*	.029 / .034
S	*lb.*	.03 / .0350

†Price quoted is f.o.b. works (bags). The price f.o.b. works (bulk) is 2.75¢ per pound; f.o.b. Hoboken (bulk), 3.63¢; f.o.b, No. Atlantic Docks (bags), 3.80¢. All prices are carlot.

Clays

Aerfloted Paragon (50-*lb. bags*)	*ton*	$10.00
Suprex (50-*lb. bags*)	*ton*	10.00
Barden	*ton*	10.00
Catalpo, *c.l.*	*ton*	30.00
Chicora	*ton*	10.00
China	*ton*	17.50 /$20.00
Crown	*ton*	10.00
Dixie	*ton*	10.00 /22.50
Hi-White	*ton*	10.00
Langford	*ton*	8.50
NcNamee	*ton*	10.00 /22.50
Par	*ton*	10.00
Paraforce, *c.l.*	*ton*	40.00
Witco, *c.l.*	*ton*	10.00
Cumar EX	*lb.*	.045
MH	*lb.*	.065 / .11
V	*lb.*	.09 / .12
Silene	*lb.*	.04 / .05

Reodorants

Amora A	*lb.*	
B	*lb.*	
C	*lb.*	
D	*lb.*	
Compound G-4	*lb.*	
G-11	*lb.*	
Curodex 19	*lb.*	2.75
188	*lb.*	3.50
Para-Dors	*lb.*	4.50
Rodo No. 0	*lb.*	3.50 / 4.00
10	*lb.*	4.50 / 5.00
198	*lb.*	

Rubber Substitutes

Black	*lb.*	.08 / .12
Brown	*lb.*	.08 / .115
White	*lb.*	.085 / .135
Factice		
Amberex	*lb.*	.25
Type B	*lb.*	.1875
Brown	*lb.*	.08 / .12
Fac-Cel B	*lb.*	.135
C	*lb.*	.135
Neophax A	*lb.*	.0975
B	*lb.*	.0975
White	*lb.*	.09 / .125

Softeners

B.R.T. No. 7	*lb.*	.0165/ .0175
Bondogen	*lb.*	.98 / 1.25
Burgundy pitch	*lb.*	.06
Cycline oil	*gal.*	.14 / .20
Dispersing Oil No. 10	*lb.*	.0335/ .036
Nuba resinous pitch (*drums*)		
Grades No. 1 and No. 2	*lb.*	.0265
Nubalene Resin	*lb.*	.025
Palm oil (Witco), *c.l.*	*lb.*	
Palmol	*lb.*	.11
Para Flux	*gal.*	.17 / .20
No. 2016	*gal.*	.19 / .20
Para Lube	*lb.*	.46 / .48
Pine tar	*gal.*	
Plastogen	*lb.*	.0775/ .10
Plastone	*lb.*	.27 / .30
R-19 Resin (*drums*)	*lb.*	.10
21 Resin (*drums*)	*lb.*	.10
Reogen	*lb.*	.115 / .22
Rosin oil, compounded	*gal.*	.40
RPA No. 1	*lb.*	.65
2	*lb.*	.65
3	*lb.*	.46
Rubtack	*lb.*	.10
Tackol	*lb.*	.085 / .18
Tonox	*lb.*	.52 / .61
Tonox D	*lb.*	.75 / .85
Witco No. 20, *l.c.l.*	*gal.*	.20
X-1 resinous oil (*tank car*)	*lb.*	.01

Softeners for Hard Rubber Compounding

Resin C. Pitch 45°C. M.P.	*lb.*	.013 / .014
60°C. M.P.	*lb.*	.013 / .014
75°C. M.P.	*lb.*	.013 / .014

Solvents

Beta-Trichlorethane	*gal.*	
Carbon bisulphide	*lb.*	
tetrachloride	*lb.*	
Cosol No. 1	*gal.*	.25 / .30
No. 2	*gal.*	.20 / .28
No. 3	*gal.*	.20 / .28
Industrial 90% benzol (*tank car*)	*gal.*	.16
Skellysolve	*gal.*	

Stabilizers for Cure

Laurex (*bags*)	*lb.*	.1075/ .1325
Stearex B	*lb.*	.0925/ .1025
Beads	*lb.*	.09 / .10
Stearic acid, single pressed	*lb.*	.0925/ .1025
Stearite, *c.l.*	100 *lbs.*	9.00
Zinc stearate	*lb.*	.24 / .26

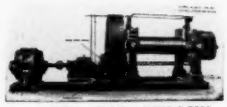
Synthetic Rubber

Neoprene Type E	*lb.*	.65
G	*lb.*	.70
GN	*lb.*	
GW	*lb.*	.75
H	*lb.*	.78
M	*lb.*	.65
Latex Type 57	*lb.*	.30
Synthetic 190	*lb.*	.55

(*Continued on page 78*)

MACHINERY by THROPP

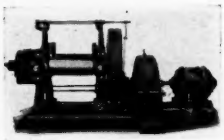
FOR TODAY'S REQUIREMENTS IN THE RUBBER INDUSTRY



20"x 22"x 60" Mill

PRODUCTION MILLS

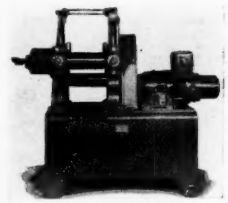
for Hard Continuous Service. Standard Sizes 60", 50", 42". Other Sizes Had on Request.



14"x 30" Mill

INTERMEDIATE MILLS

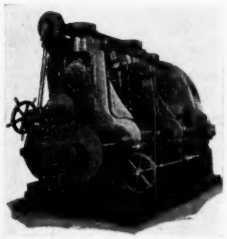
for Plastics and Rubber. Roller Bearing Drives. Standard Sizes 30" x 24".



6"x 12" Mill

LABORATORY MILLS

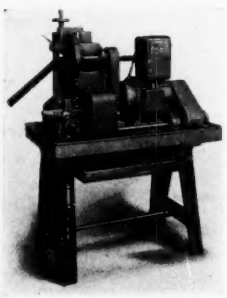
for All Types of Work. Wide Range of Sizes. Std. Size, 6x16, 6x12, 3x8, 2x6.



Calenders

CALENDERS

for Laboratory and Production. Custom-Built to Your Requirements.



Washer Cutter

SPECIAL CUTTERS

for Cutting Washers, Stock, Etc. In a Wide Range of Lengths and Diameters.

WRITE FOR LITERATURE ON THE MACHINE YOU NEED.

WM. R. THROPP & SONS CO.

TRENTON, N. J. **EST. 1888**

Regular and Special Constructions of

COTTON FABRICS

Single Filling **Double Filling**

and

ARMY

Ducks

HOSE and BELTING

Ducks

Drills

Selected

Osnaburgs

Curran & Barry

320 BROADWAY

NEW YORK

COTTON AND FABRICS

NEW YORK COTTON EXCHANGE WEEK-END CLOSING PRICES

Futures	Apr. 27	May 25	June 1	June 8	June 15	June 22
May	10.94	....	....	....	....	....
June	10.80	9.82	9.00	9.93	....	....
July	10.67	9.67	9.59	9.78	10.51	10.50
Sept.	10.37	9.13	8.99	9.11	9.40	9.41
Dec.	10.02	8.70	8.54	8.60	9.31	9.24
Mar.	9.86	8.51	8.34	8.39	9.08	8.97
May	....	....	8.22	8.24	8.93	8.81

New York Quotations

June 24, 1940

Drills

38-inch 2.00-yard	yd.	$0.11¼
40-inch 3.47-yard		.06⅝
50-inch 1.52-yard		.15⅜
52-inch 1.85-yard		.13
52-inch 1.90-yard		.12⅞
52-inch 2.20-yard		.11½
52-inch 2.50-yard		.10⅛
59-inch 1.85-yard		.13¼

Ducks

38-inch 2.00-yard D. F.	yd.	.11¼/.12½
40-inch 1.45-yard S. F.		.15⅞
51½-inch 1.35-yard D. F.		.18½
72-inch 1.05-yard D. F.		.24½/.26½
72-inch 17.21-ounce		.27¾

Mechanicals

Hose and belting	lb.	.25

Tennis

52-inch 1.35-yard	yd.	.17

Hollands

Gold Seal and Eagle

20-inch No. 72	yd.	.10
30-inch No. 72		.18
40-inch No. 72		.20

Red Seal and Cardinal

20-inch	yd.	.08½
30-inch		.15¼
40-inch		.17
50-inch		.26

Osnaburgs

40-inch 2.34-yard	yd.	.09⅝
40-inch 2.48-yard		.09⅛
40-inch 2.56-yard		.08⅛
40-inch 3.00-yard		.07⅝
40-inch 7-ounce part waste		.08⅜
40-inch 10-ounce part waste		.11⅜
37-inch 2.42-yard		.09⅛

Raincoat Fabrics

Cotton

Bombazine 60 x 64	yd.	.07½
Plaids 60 x 48		.10½
Surface prints 60 x 64		.11½
Print cloth, 38½-inch, 60 x 64		.04¾

Sheetings, 40-inch

48 x 48, 2.50-yard	yd.	.08
64 x 68, 3.15-yard		.07¾
56 x 60, 3.60-yard		.06¾
44 x 40, 4.25-yard		.05

Sheetings, 36-inch

48 x 48, 5.00-yard	yd.	.04½
44 x 40, 6.15-yard		.03⅝

Tire Fabrics

Builder

17¼ ounce 60" 23/11 ply Karded peeler	lb.	.30½

Chafer

14 ounce 60" 20/8 ply Karded peeler	lb.	.30
9¼ ounce 60" 10/2 ply Karded peeler	lb.	.29½

Cord Fabrics

23/5/3 Karded peeler, 1/$_{16}$" cotton	lb.	.31
15/3/3 Karded peeler, 1/$_{16}$" cotton	lb.	.29
12/4/2 Karded peeler, 1/$_{16}$" cotton	lb.	.28
23/5/3 Karded peeler, 1¼" cotton	lb.	.36½
23/5/3 Combed Egyptian	lb.	.50

Lese Breaker

8¼ ounce and 10¼ ounce 60" Karded peeler	lb.	.32½

THE cotton market advanced during June, regaining ground lost in May. The rise was attributed in part to favorable news of domestic consumption as revealed by activity in the Worth St. textile markets. The New York 1/$_{16}$-inch spot middling price, after closing at 10.41¢ per pound on May 31, advanced to close at 11.22¢ per pound on June 22. The closing price on June 29 was 10.93¢ per pound, with the market moderate.

The Census Bureau reported May consumption of all cotton, exclusive of linters, in domestic mills at 636,467 bales, against 623,893 bales in April and 606,090 bales in May, 1939. Exports of cotton in May totaled 226,469 bales, against 344,609 in April and 142,577 in May, 1939. Stocks of cotton in consuming establishments at the end of May were 1,314,105 bales, against 1,469,617 at the end of April, and 1,175,357 on May 31, 1939. May consumption was larger than expected.

It was reported that requests for release of loan cotton from the 1938 Government holdings have been coming in. Supplies of cotton outside the loan are said to be very light and offerings scarce. Total shipments of barter cotton to England to the middle of June were about 225,000 bales out of about 690,000 bales involved in the agreement. Shipments recently have been reported to be very light.

The involvement of Italy in the war was expected to result in cutting off export trade with that country. The spread of the European war has led to almost complete elimination of continental Europe as a market for American cotton, at least for the time being. *The Journal of Commerce* estimates the trade which has been lost at 3,084,000 bales, on an annual basis.

On June 3, Robert J. Murray, vice president of the New York Cotton Exchange, was elected president. The retiring president, Frank J. Knell, was chosen president of the Wool Top Exchange at the annual election of the Wool Associates of the New York Cotton Exchange.

Fabrics

The market for fabrics of heavy construction continued dull during the first week of June. During the second week, however, the market experienced the heaviest volume of cotton gray goods trading since the war buying boom of last September. Trading was abruptly halted upon news of the French surrender, but bullish sentiment prevailed with the belief that the U. S. Government defense buying would offset any loss in trade resulting from the turn of events in Europe. Army purchases of heavy goods were increasing.

The market in general is easier, with prices of several types of construction somewhat below last month's levels. Belief in the trade persists that prices will move higher during the balance of the year.

"Eastman Organic Chemicals. List No. 31, 1940." Eastman Kodak Co., Rochester, N. Y. 128 pages. This catalog lists more than 3,300 different chemicals, including 77 items not covered in previous lists. Prices and melting or boiling points are given.

Current Quotations

(*Continued from page 76*)

Tackifier

B.R.H. No. 2	lb.	$0.017 /$0.02

Varnish

Shoe	gal.	1.45

Vulcanizing Ingredients

Sulphur Chloride (drums)	lb.	.035 / .04
Rubber	100 lbs.	2.00
Telloy	lb.	1.75
Vandex	lb.	1.75

(See also Colors—Antimony)

Waxes

Carnauba, No. 3 chalky	lb.
2 N.C.	lb.
3 N.C.	lb.
1 Yellow	lb.
2	lb.
Montan, crude	lb.

Rubber and Canvas Footwear Statistics

	Thousands of Pairs		
	Inventory	Production	Shipments
1937	20,430	74,102	67,191
1938	16,183	50,812	54,942
1939	16,388	60,612	60,377
1940			
Jan.	15,018	5,044	6,389
Feb.	15,319	5,062	4,761
Mar.	15,656	4,869	4,532
Apr.	16,881	5,128	3,902

The above figures have been adjusted to represent 100% of the industry based on reports received which represented 81% for 1936-37.

Source: *Survey of Current Business*, Bureau of Foreign & Domestic Commerce, Washington, D. C.

U. S. Crude and Waste Rubber Imports for 1940

	Plantations	Latex	Paras	Africans	Centrals	Guayule	Totals 1940	Totals 1939	Balata	Miscellaneous	Waste
Jan. ..... tons	68,832	2,768	406	161	74	255	72,496	39,082	107	648	241
Feb.	40,338	1,458	553	453	30	256	43,088	36,490	75	316	34
Mar.	56,008	2,720	119	49	42	320	59,258	38,989	89	659	26
Apr.	66,688	3,219	374	97	12	309	70,699	29,601	63	581	8
May	44,310	2,883	729	186	24	288	48,420	47,535	150	596	204
Total 5 mos., 1940 ..... tons	276,176	13,048	2,181	946	182	1,428	293,961	.....	484	2,800	513
Total 5 mos., 1939 ..... tons	179,297	7,820	1,928	1,515	24	1,113	.....	191,697	282	3,171	808

Compiled from The Rubber Manufacturers Association, Inc. statistics.

Drawn from Primitive Painting of Hand Spinning on Greek vase, 500 B. C., now in British Museum.

The art of spinning fibers into yarn is an ancient one—but for thousands of years it remained much the same primitive operation pictured here. This method of spinning made no allowance for the blending of fiber; depended on sight and touch for yarn size and did not control degree of twist.

Proper blends, exact sizes and uniform twists are the very foundation of our mass production of Industrial Fabrics. Our constant control of processes enables us to make fabrics year in and year out within the close limits of tolerance permitted by the engineering specifications for such products.

FOR INSTANCE: *Fabrics for the Rubber Industry*

Shawmut Belting Duck

We supply a large number of standard fabrics made especially for the rubber industry. In addition to standard constructions available from stock, we are in a position to cooperate with rubber manufacturers in the development of special specification fabrics to meet unusual requirements.

WELLINGTON SEARS COMPANY
65 WORTH STREET • NEW YORK, N. Y.

Dominion of Canada Statistics

Imports of Crude and Manufactured Rubber

Unmanufactured	March, 1940 Quantity	March, 1940 Value	Three Months Ended March, 1940 Quantity	Three Months Ended March, 1940 Value
Crude rubber, etc. lb.	6,730,296	$1,441,537	25,505,001	$5,229,090
Latex (dry weight) lb.	128,256	36,986	516,482	145,409
Gutta percha lb.	3,001	2,019	5,860	3,983
Rubber, recovered lb.	1,226,900	65,983	3,326,700	180,383
Rubber, powdered, and gutta percha scrap lb.	488,800	7,665	1,588,300	31,093
Balata lb.	745	546	1,280	873
Rubber substitute lb.	24,100	4,517	83,200	22,083
Totals	8,602,098	$1,559,253	31,026,823	$5,612,914
Partly Manufactured				
Hard rubber comb blanks	.....	$4,513	.....	$7,963
Hard rubber, n. o. s. lb.	6,279	7,043	13,489	13,453
Rubber thread not covered lb.	3,871	3,257	12,204	12,158
Totals	10,150	$14,813	25,693	$33,574
Manufactured				
Bathing shoes prs.	.....	.....	144	$27
Belting	.....	$10,387	.....	37,735
Hose	.....	17,101	.....	44,049
Packing	.....	7,580	.....	21,787
Boots and shoes prs.	510	540	2,001	3,121
Canvas shoes with rubber soles prs.	1,776	707	3,111	1,088
Clothing, including waterproofed	.....	5,038	.....	9,822
Raincoats no.	3,690	15,321	5,655	22,039
Gloves doz. prs.	721	2,275	1,899	6,396
Hot water bottles	.....	329	.....	1,221
Liquid rubber compound	.....	38,576	.....	83,824
Tires, bicycle no.	2,564	1,509	14,404	8,456
Pneumatic no.	1,260	26,419	3,958	60,605
Solid for automobiles and motor trucks no.	6	438	118	2,872
Other solid tires	.....	487	.....	2,387
Inner tubes no.	493	1,155	1,541	3,641
Bicycle no.	2,520	532	12,042	2,607
Mats and matting	.....	5,356	.....	20,431
Cement	.....	9,848	.....	30,194
Golf balls doz. prs.	3,278	5,616	4,476	7,981
Heels prs.	7,395	673	19,873	1,779
Other rubber manufactures	.....	155,206	.....	474,339
Totals	.....	$305,093	.....	$846,401
Totals, rubber imports	.....	$1,879,159	.....	$6,492,889

Exports of Domestic and Foreign Rubber Goods

Unmanufactured	Produce of Canada Value	Reexports of Foreign Goods Value	Produce of Canada Value	Reexports of Foreign Goods Value
Waste rubber	$8,913	.....	$35,922	.....
Manufactured				
Belting	$50,630	.....	$157,076	.....
Bathing caps	53	.....	63	.....
Canvas shoes with rubber soles	100,045	.....	194,395	.....
Boots and shoes	344,558	.....	1,313,149	.....
Clothing, including waterproofed	26,080	.....	94,104	.....
Heels	14,475	.....	41,016	.....
Hose	46,504	.....	126,990	.....
Soles	22,011	.....	52,240	.....
Soling slabs	3,898	.....	14,242	.....
Tires, pneumatic	624,406	.....	1,762,810	.....
Not otherwise provided for	39	.....	56	.....
Inner tubes	53,555	.....	139,812	.....
Other rubber manufactures	59,123	$304	173,159	$10,435
Totals	$1,345,377	$304	$4,069,112	$10,435
Totals, rubber exports	$1,354,290	$304	$4,105,034	$10,435

Imports by Customs Districts

	April, 1940 *Crude Rubber Pounds	April, 1940 *Crude Rubber Value	April, 1939 *Crude Rubber Pounds	April, 1939 *Crude Rubber Value
Massachusetts	15,105,058	$2,693,467	7,907,513	$1,262,859
Buffalo	100,620	17,231	54,000	11,200
New York	104,382,463	18,394,989	37,658,159	5,766,874
Philadelphia	1,952,120	330,731	918,261	128,945
Maryland	14,188,408	2,415,976	2,116,521	281,867
Mobile	346,175	58,938	1,650,367	248,481
Georgia	.....	.....	1,141,089	167,525
New Orleans	7,911,332	1,391,670	8,471,279	1,293,959
Galveston	112,000	20,767	67,262	10,246
El Paso	123,200	10,670	179,800	3,530
Los Angeles	9,640,534	1,709,957	10,717,213	1,482,237
San Francisco	819,548	145,360	788,382	115,901
Oregon	.....	.....	11,200	1,960
Ohio	2,856,565	516,379	400	194
Tennessee	268,775	48,527	.....	.....
Colorado	560,000	95,249	67,200	9,670
Totals	158,366,798	$27,849,911	71,748,646	$10,785,448

*Crude rubber including latex dry rubber content.

Dividends Declared

Company	Stock	Rate	Payable	Stock of Record
Armstrong Rubber Co., Inc.	Com.	$2.00	June 25	June 10
American Hard Rubber Co.	Pfd.	$2.00 q.	June 29	June 14
Baldwin Rubber Co.	Com.	$0.125	July 20	July 15
Canadian General Electric Co., Ltd.	Com.	$2.00	July 1	June 15
Detroit Gasket & Mfg. Co.	Com.	$0.25	July 20	July 5
Dewey & Almy Chemical Co.	Pfd.	$1.25 q.	June 15	May 31
Dominion Textile Co., Ltd.	Com.	$1.25 q.	July 2	June 15
Dominion Textile Co., Ltd.	7% Pfd.	$1.25 q.	July 2	June 15
Dow Chemical Co.	Com.	$0.75	Aug. 15	Aug. 1
Dow Chemical Co.	Pfd.	$1.25 q.	Aug. 15	Aug. 1
Electric Storage Battery Co.	Com.	$0.50	June 29	June 8
Electric Storage Battery Co.	Pfd.	$0.50	June 29	June 8
Firestone Tire & Rubber Co.	Com.	$0.25	July 20	July 5
Garlock Packing Co.	Com.	$0.75 incr.	June 29	June 22
General Electric Co.	Com.	$0.35	July 25	June 28
General Tire & Rubber Co.	Pfd.	$1.50 q.	June 29	June 19
B. F. Goodrich Co.	Pfd.	$1.25 q.	June 29	June 21
Goodyear Tire & Rubber Co. of Canada, Ltd.	Com.	$0.63 q.	July 2	June 15
Goodyear Tire & Rubber Co. of Canada, Ltd.	5% Cum. Pfd.	1¼%	July 2	June 15
Hercules Powder Co.	Com.	$0.60	June 25	June 14
Hewitt Rubber Co.	Com.	$0.25	June 15	June 1
Jenkins Bros.	Non-Voting Com.	$0.25	June 25	June 13
Jenkins Bros.	Founders Shares	$1.00	June 25	June 13
Jenkins Bros.	7% Pfd.	$1.75 q.	June 25	June 13
I. B. Kleinert Rubber Co.	Com.	$0.20	June 29	June 15
Mansfield Tire & Rubber Co.	Conv. Pfd.	$0.30 q.	July 1	June 15
Mansfield Tire & Rubber Co.	Com.	$0.10 reduced	June 20	June 11
Midwest Rubber Reclaiming Co.	$4 Pfd.	$1.00 q.	June 1	May 20
Pharis Tire & Rubber Co.	Com.	$0.15	June 20	June 5
Rome Cable Corp.	Com.	$0.10	July 1	June 14
Seiberling Rubber Co.	Pr. Pfd.	$0.62 q.	July 1	June 20
Seiberling Rubber Co.	"A" Pfd.	$1.25 q.	July 1	June 20
Thermoid Co.	$3 Pfd.	$1.00 accum.	June 15	June 3
United Elastic Corp.	Com.	$0.15	June 24	June 1
U.S. Rubber Reclaiming Co.	8% Pr. Pfd.	$0.50 accum.	June 24	June 21

Shipments of Crude Rubber from Producing Countries—Long Tons

Year	Malaya including Brunei and Labuan	N.E.I.	Ceylon	India	Burma	North Borneo	Sarawak	Thailand	French Indo-China	Total	Philippines and Oceania	Liberia†	Other Africa	South America	Mexican Guayule	Grand Total
1938	372,000	298,100	49,500	8,500	6,700	9,500	17,800	41,600	59,200	862,900	2,000*	2,900	9,000*	15,300	2,800	894,900
1939	376,755	371,946	61,028	9,241	6,616	11,864	24,014	41,266	65,219	967,949	2,080*	5,435	9,600	16,094	2,357	1,004,015
1939																
Jan.	24,393	38,680	7,237	764	1,115	1,604	2,342	2,918	4,532	83,585	220	528	800	1,812	347	87,292
Feb.	29,278	24,996	5,495	947	618	664	1,484	5,606	5,293	74,381	158	435	800	1,187	319	77,280
Mar.	29,298	27,933	3,718	773	619	344	1,177	5,401	4,501	73,764	230	427	800	1,407	210	76,838
Apr.	29,779	28,338	2,225	881	379	1,687	2,446	2,660	2,657	71,052	135	533	800	1,206	167	73,893
May	29,598	24,429	2,805	1,002	668	558	1,649	2,782	4,584	68,075	129	...	800	1,077	231	70,312
June	22,052	27,510	3,707	630	805	332	1,157	1,748	4,663	62,604	140	667	800	676	166	65,053
July	26,013	35,679	5,019	782	503	1,603	3,092	5,599	3,367	81,657	190	516	800	1,071	264	84,498
Aug.	40,973	27,477	5,620	203	213	975	1,749	5,230	7,020	89,460	234	222	800	1,313	378	92,407
Sept.	26,908	37,755	6,064	691	89	429	1,932	4,670	5,943	84,481	94	599	800	1,356	46	87,376
Oct.	49,458	44,998	5,234	665	150	1,730	2,487	2,047	5,022	111,791	122	561	800	1,524	356	115,154
Nov.	35,773	30,234	4,402	370	449	1,322	2,023	1,428	6,540	82,541	254	614	800	1,198	137	85,544
Dec.	33,232	23,917	9,502	1,533	1,008	616	2,476	1,177	11,097	84,558	174	333	800	2,267	236†	88,368
1940																
Jan.	26,229	54,148	7,698	839	833	1,858	2,256	5,722	5,238	104,821	120	1,191	900	1,550	128†	108,710
Feb.	45,651	37,958	8,946	1,184*	892	1,164	2,678	4,307	6,931	109,711	94	477	900	1,662	314†	113,158
Mar.	47,885	42,407	5,305	1,183*	871	1,050	3,526	3,111	3,551	108,889	200*	548	900	1,482	200*	112,219
Apr.	25,454	44,357	4,148	1,183*	990	1,799	2,951	1,834	4,000*	86,716	200*	600*	900	1,500*	200*	90,116

* Estimated. †Guayule rubber imports into U.S.A. provisional until export figures from Mexico are received. Source: *Statistical Bulletin of the International Rubber Regulation Committee.*

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(*Advertisements continued on page* 83)

United States Statistics

Imports for Consumption of Crude and Manufactured Rubber

	March, 1940 Quantity	March, 1940 Value	Three Months Ended March, 1940 Quantity	Three Months Ended March, 1940 Value
UNMANUFACTURED—*Free*				
Liquid latex (solids)....*lb.*	7,561,780	$1,473,056	20,117,604	$3,833,308
Jelutong or pontianak....*lb.*	1,214,159	162,493	3,616,817	452,941
Balata ....*lb.*	101,867	20,895	299,779	66,798
Gutta percha ....*lb.*	767,761	88,689	1,356,460	187,109
Guayule ....*lb.*	816,700	81,181	1,806,500	179,333
Scrap and reclaimed....*lb.*	605,264	8,223	2,142,305	39,072
Totals	11,067,531	$1,834,537	29,339,465	$4,758,556
Misc. rubber (above), 1,000 *lbs.*	11,067	$1,834,537	29,339	$4,758,556
Crude rubber....1,000 *lbs.*	124,358	21,845,290	369,775	63,738,307
Totals ....1,000 *lbs.*	135,425	$23,679,827	399,114	$68,496,863
Chicle, crude ....*lb.*	244,481	$77,446	3,553,152	$1,147,235
MANUFACTURED—*Dutiable*				
Rubber tires ....*no.*	10,320	$75,426	21,717	$144,315
Rubber boots, shoes and overshoes ....*prs.*	333	285	8,487	2,096
Rubber soled footwear with fabric uppers ....*prs.*	55,252	10,435	229,494	33,986
Golf balls ....*no.*	73,874	7,373	164,642	15,453
Lawn tennis balls....*no.*	187,680	18,058	425,028	38,441
Other rubber balls....*no.*	165,062	5,105	676,444	25,525
Other rubber toys....*lb.*	.....	2,396	.....	10,741
Hard rubber combs....*no.*	.....	.....	.....	.....
Other manufactures of hard rubber	.....	2,148	.....	7,015
Friction or insulating tape.*lb.*	3,102	3,259	18,173	9,625
Belts, hose, packing, and insulating material	.....	4,606	.....	31,909
Druggists' sundries of soft rubber	.....	4,524	.....	10,877
Inflatable swimming belts, floats, etc. ....*no.*	82,791	5,421	345,017	22,609
Other rubber and gutta percha manufactures	.....	14,932	.....	54,004
Totals	.....	$153,968	.....	$406,596

Exports of Foreign Merchandise

RUBBER AND MANUFACTURES				
Crude rubber ....*lb.*	2,183,659	$447,460	7,215,325	$1,494,952
Balata ....*lb.*	48,591	19,386	225,995	69,692
Other rubber, rubber substitutes and scrap....*lb.*	25	19	2,261	332
Rubber manufactures (including toys)	.....	7,017	.....	12,609
Totals	.....	$473,882	.....	$1,577,585

Exports of Domestic Merchandise

RUBBER AND MANUFACTURES				
Reclaimed ....*lb.*	3,180,373	$164,311	8,768,095	$445,262
Scrap ....*lb.*	8,983,362	196,500	21,658,146	425,885
Cements ....*gal.*	48,830	62,936	106,857	136,743
Rubberized auto cloth.*sq. yd.*	20,301	8,223	64,666	30,009
Other rubberized piece goods and hospital sheeting.*sq. yd.*	187,727	66,022	569,628	195,358
Boots ....*prs.*	5,022	13,160	60,241	124,558
Shoes ....*prs.*	23,540	15,764	54,587	36,503
Canvas shoes with rubber soles ....*prs.*	32,061	25,978	93,866	74,677
Soles ....*doz. prs.*	4,987	9,423	11,790	21,688
Heels ....*doz. prs.*	30,097	17,087	83,606	51,241
Soling and top lift sheets.*lb.*	89,245	17,320	325,712	57,915
Gloves and mittens..*doz. prs.*	11,811	28,750	39,365	87,997
Water bottles and fountain syringes ....*no.*	31,493	10,192	74,191	25,292
Other druggists' sundries...	.....	85,521	.....	225,475
Gum rubber clothing....*doz.*	24,643	69,917	52,560	138,026
Balloons ....*gross*	20,371	16,280	61,052	53,516
Toys and balls	.....	7,990	.....	22,085
Bathing caps ....*doz.*	7,277	11,728	14,760	27,051
Bands ....*lbs.*	27,903	13,775	69,109	35,271
Erasers ....*lb.*	31,322	17,464	78,119	45,467
Hard rubber goods				
Electrical battery boxes.*no.*	19,976	13,894	76,002	53,960
Other electrical....*lb.*	65,475	29,547	151,293	65,956
Combs, finished ....*doz.*	22,363	11,808	51,779	27,689
Other hard rubber goods...	.....	13,976	.....	41,119
Tires				
Truck and bus casings.*no.*	28,889	590,010	101,789	2,094,049
Other auto casings....*no.*	47,464	503,976	155,776	1,708,986
Tubes, auto ....*no.*	46,060	83,184	176,801	324,930
Other casings and tubes.*no.*	7,329	62,259	20,095	136,648
Solid tires for automobiles and motor trucks....*no.*	273	5,297	1,204	27,179
Other solid tires....*lb.*	10,335	3,115	63,805	11,970
Tire sundries and repair materials ....*lb.*	259,495	76,338	756,608	220,380
Rubber and friction tape..*lb.*	79,892	23,975	246,101	68,100
Fan belts for automobiles.*lb.*	44,453	23,830	126,993	66,020
Other rubber and balata belts ....*lb.*	354,075	177,337	1,108,191	556,332
Garden hose ....*lb.*	81,265	14,956	254,189	43,993
Other hose and tubing....*lb.*	526,927	213,492	2,277,423	903,320
Packing ....*lb.*	137,244	63,371	383,861	181,918
Mats, matting, flooring, and tiling ....*lb.*	94,922	13,541	307,911	41,978
Thread ....*lb.*	114,858	74,089	317,270	220,636
Gutta percha manufactures.*lb.*	167,940	47,472	463,761	134,856
Latex (d.r.c.) and rubber sheets processed for further manufacture....*lb.*	213,159	39,615	342,887	67,295
Other rubber manufactures..	.....	226,200	.....	575,333
Totals	.....	$3,169,623	.....	$9,842,675

† Purchase.

Rubber Questionnaire—1st Quarter, 1940*

	Inventory at End of Quarter (Long Tons)	Production (Long Tons)	Shipments (Long Tons)	Consumption (Long Tons)
RECLAIMED RUBBER				
Reclaimers solely (6)	7,735	22,846	18,887	.....
Manufacturers who also reclaim (19)..	7,140	17,847	2,563	17,321
Other manufacturers (115)....	5,365	.....	.....	14,928
Totals	20,240	40,693	21,450	32,249

	In-ventory (Long Tons)	Con-sumption (Long Tons)	Due on Contracts (Long Tons)
SCRAP RUBBER			
Reclaimers solely (6)....	34,551	21,468	9,746
Manufacturers who also reclaim (16)..	32,689	21,569	17,013
Other manufacturers (11)....	157	.....	.....
Totals	67,397	43,037	26,759

Tons of Rubber Consumed in Rubber Products and Total Sales Value of Shipments

	Rubber Consumed Long Tons	Total Sales Value of Shipments of Manufactured Rubber Products
PRODUCTS		
Tires and Tire Accessories		
Passenger car, truck, and bus casings....	72,055	$64,847,000
Inner tubes for passenger cars, trucks, and buses	10,114	8,392,000
Farm tractor and implement casings and tubes..	3,391	3,906,000
Airplane tires and tubes....	132	307,000
Motorcycle casings and tubes....	71	101,000
Bicycle tires, including juvenile pneumatics (single tubes, casings and tubes)....	616	806,000
Solid and cushion tires for highway transportation	32	80,000
All other solid and cushion tires....	125	368,000
Tire sundries and repair materials....	2,213	2,721,000
Totals	88,749	$81,528,000
OTHER RUBBER PRODUCTS		
Mechanical rubber goods....	11,087	$34,683,000
Boots and shoes....	3,571	12,309,000
Insulated wire and cable compounds....	1,802	†
Druggists' sundries, medical and surgical rubber goods	1,048	3,077,000
Stationers' rubber goods	514	707,000
Bathing apparel	214	423,000
Miscellaneous rubber sundries....	576	1,491,000
Rubber clothing	76	350,000
Automobile fabrics	80	292,000
Other rubberized fabrics....	927	2,880,000
Hard rubber goods....	857	2,199,000
Heels and soles....	2,902	3,588,000
Rubber flooring	354	538,000
Sponge rubber	2,346	3,240,000
Sporting goods, toys, and novelties....	550	1,587,000
	26,904	$68,364,000
Totals		
Grand totals—all products....	115,653	$149,892,000

Inventory of Rubber in the United States and Afloat

	Crude Rubber on Hand (Long Tons)	Crude Rubber Afloat (Long Tons)
Manufacturers	68,718	19,584
Importers and dealers	19,822	68,571
Totals	88,540	88,155

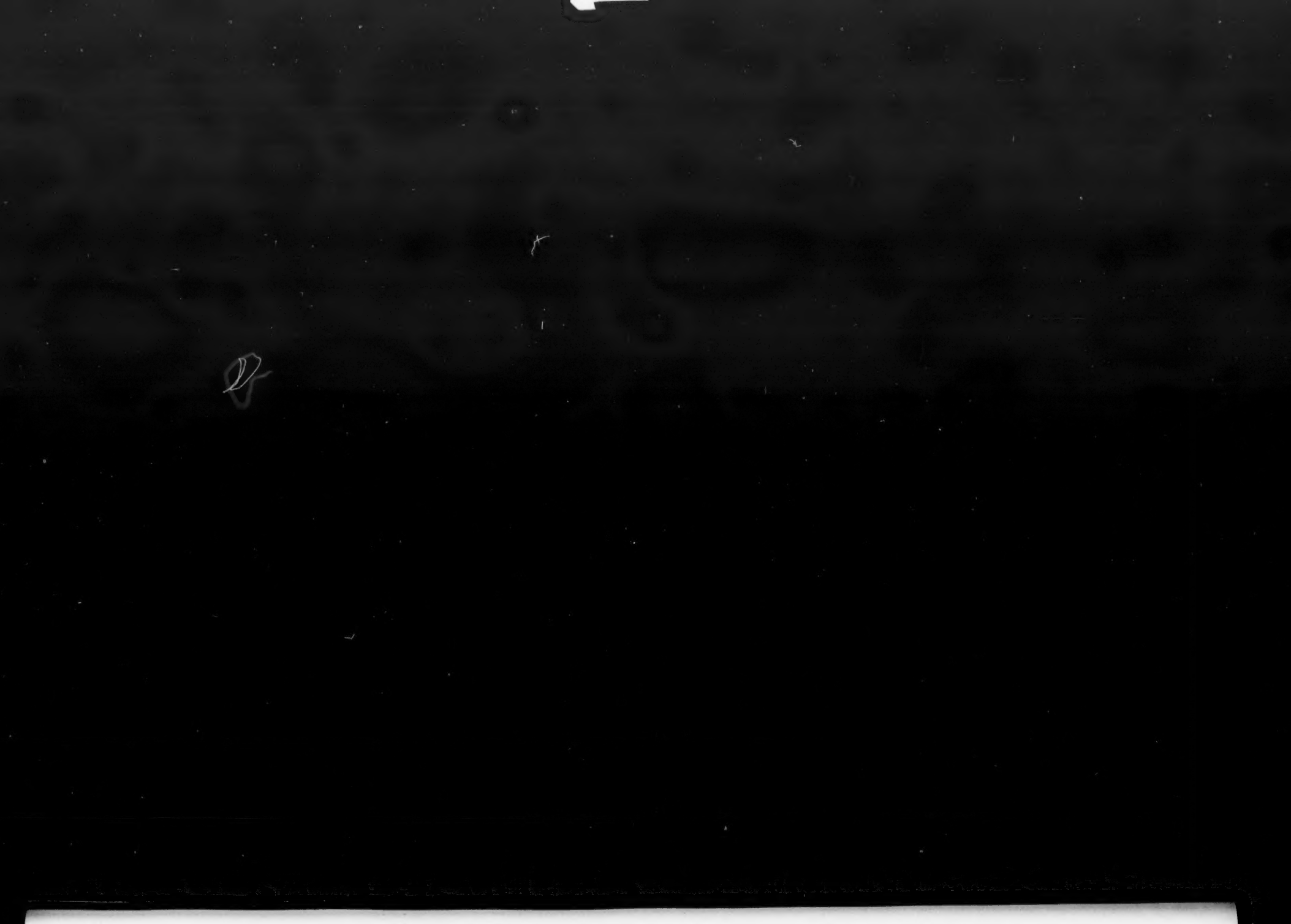
*Number of rubber manufacturers that reported data was 189; crude rubber importers and dealers, 46; reclaimers (solely), 6; total daily average number of employes (reporting manufacturers and reclaimers), 143,633.

It is estimated that the reported grand total crude rubber consumption is 74.6%; grand total sales value, 75%; the grand total crude rubber inventory, 66.2%; afloat figures, unavailable; the reclaimed rubber production, 74.6%; reclaimed consumption, 68.1; and reclaimed inventory, 71% of the total of the entire industry.

† Owing to the difficulty of securing representative sales figures this item has been discontinued.

Compiled from R.M.A. statistics.

Foreign Trade Information

For further information concerning the inquiries listed below address United States Department of Commerce, Bureau of Foreign and Domestic Commerce, Room 734, Custom House, New York, N. Y.

No.	Commodity	City and Country
† 34	Washable animals and dolls of rubber..	Montreal, Canada
† 37	Waterproof and leatherette cloth....	Capetown, South Africa
† 41	Antioxidants for preserving hard rubber, and raw rubber, 10 tons....	Maribor, Yugoslavia
† 44	Rubber corset buttons....	Birmingham, England
† 61	Colored rubber sheeting....	Singapore, Straits Settlements
† 81	Vulcanized fiber tubing....	London, England
† 83	Canvas fire hose, 12,000 and more feet..	Bribane, Australia
†107	Druggists' sundries (dipped goods).....	Cairo, Egypt
†108	Insulated wire	Cairo, Egypt
†109	Insulated wires and cables....	Buenos Aires, Argentina